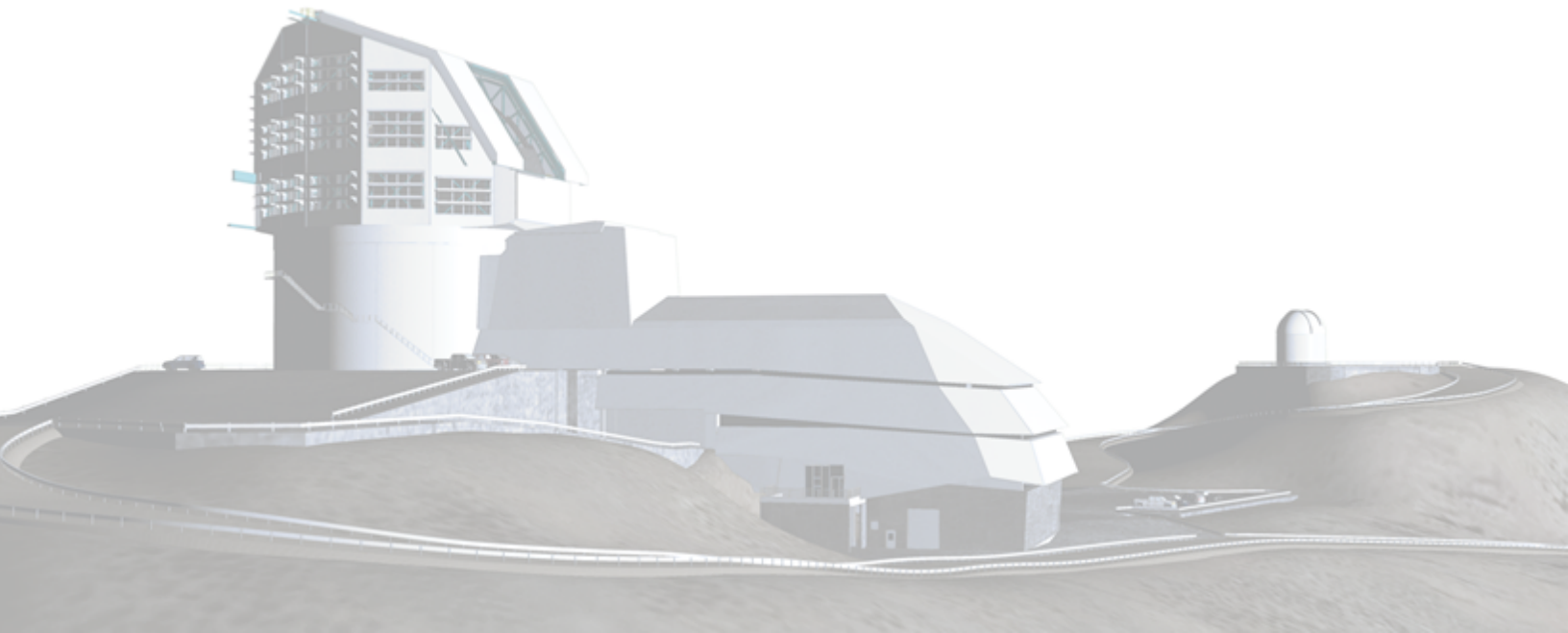

Vera C. Rubin Observatory
Rubin Observatory Operations

Management and Execution plan for Data Management Operations.

William O'Mullane

RTN-046

Latest Revision: 2026-04-29

Abstract

This is the management plan for operations of Data Management - this includes software products and data products.

Change Record

Version	Date	Description	Owner name
1.2	2026-04-29	Updaed org better tables	William O'Mullane
1.1	2026-04-06	Including CST.	William O'Mullane
1.0	2026-04-06	Including usdf services	William O'Mullane
0.2	2026-01-26	Draftincluding DM Science	William O'Mullane
0.1	2023-01-10	Draft.	William O'Mullane

Document source location: `https://github.com/lsst/rtn-046`

Contents

Management and Execution plan for Data Management Operations.

1 Introduction

1.1 Purpose

This document defines the mission, goals and objectives, organization and responsibilities of Vera C. Rubin Observatory Data Management Operations.

1.2 Mission Statement

Maintain, improve and operate a suite of Vera C. Rubin data management services to produce and serve to the community high-quality data products from the Legacy Survey of Space and Time.

1.3 Goals and Objectives

These are similar to our construction goals outlined in LDM-294. Rubin Data Management Operations will:

- Produce the data products as outlined in LSE-61
- Provide DM verification and validation of data products.
- Maintain and improve data production mechanisms.
- Maintain and improve data access mechanisms.
- Maintain and improve data abstraction mechanisms.
- Provide community support, documentation and tutorials.
- Assess current and operations-era technologies for use in providing engineered solutions for Vera C. Rubin Observatory .
- Maintain appropriate cybersecurity measures throughout Vera C. Rubin Observatory and especially on external facing services.
- Document the operational procedures associated with using and maintaining DM capabilities.

- Evaluate, select, recruit, hire/contract and direct permanent staff, contract, and in-kind resources in Rubin and from partner organizations participating in DM initiatives.

The goals in selecting and, where necessary, developing Rubin software solutions are:

- We prefer to acquire and configure existing, off-the-shelf, solutions. Where no satisfactory off-the-shelf solutions are available, we develop the software and hardware systems necessary to meet our objectives. This extends into maintenance where we will continue to probe choices and may replace custom systems with off-the-shelf solutions where appropriate.
- The software architecture is actively managed at the subsystem level. A well engineered and cleanly designed codebase is less buggy, more maintainable, and makes developers who work on it more productive. We continue to follow and maintain the developer guide[1].
- Other than when prohibited by licensing, security, or other similar considerations, all newly developed source code, and in particular that pertaining to scientific algorithms, is public. Our primary goals in publicizing the code are to simplify reproducibility of LSST data products and to provide insight into algorithms used. Achieving these goals requires that the software must be properly documented.
- Background decision material on choices made will be documented in technical notes with "DMTN", "RTN" or similar series handles. (see `lsst.io`)

2 Architecture

The construction era DM architecture is defined in LDM-148.

As stated in the introduction our operational goals now include production of the data products. In broad terms we may think if two prongs in data management: Data Production and Data Serving. This is depicted in Figure 3.

We also now have three operational data facilities for data release production and a Cloud Facility on Google for the science users. This is all depicted in Figure 1.

Details about the build up the data facilities is given in RTN-021.

[1] `developer.lsst.io`

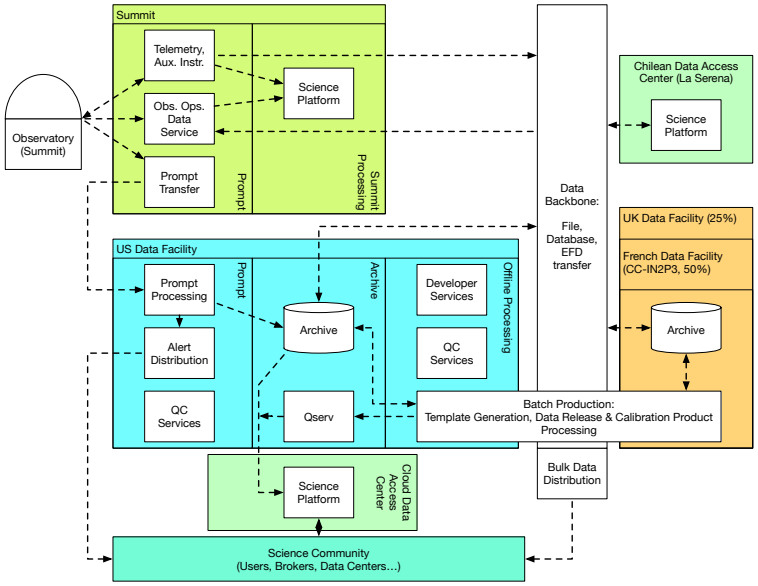

FIGURE 1: Simplified operations architecture for Data Management.

3 Functionality based teams and organisation

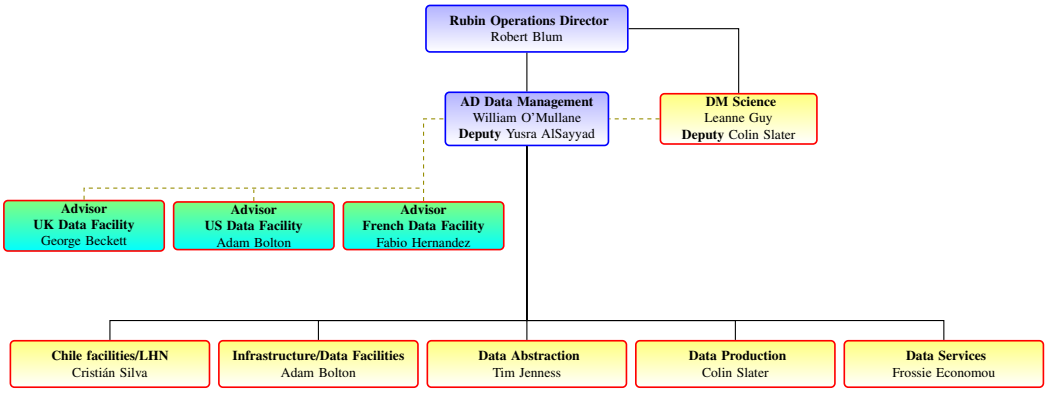

FIGURE 2: Reporting lines in Data Management Operations for the Areas of Oversight.

While Figure 2 Shows the operations reporting structure Figure 3 for Data Management. We consider the main areas of oversight to be Data Production and Data Serving, these are supported by the data abstraction team and the data facilities. In addition we have Data Science which helps us interprets scientific needs in DM and works with Summit operations to understand their needs and provide feed-

back. Each of these Areas of oversight has a manger as shown in Figure 2. There may be multiple teams within each area. Teams, products and activities are shown in section 7

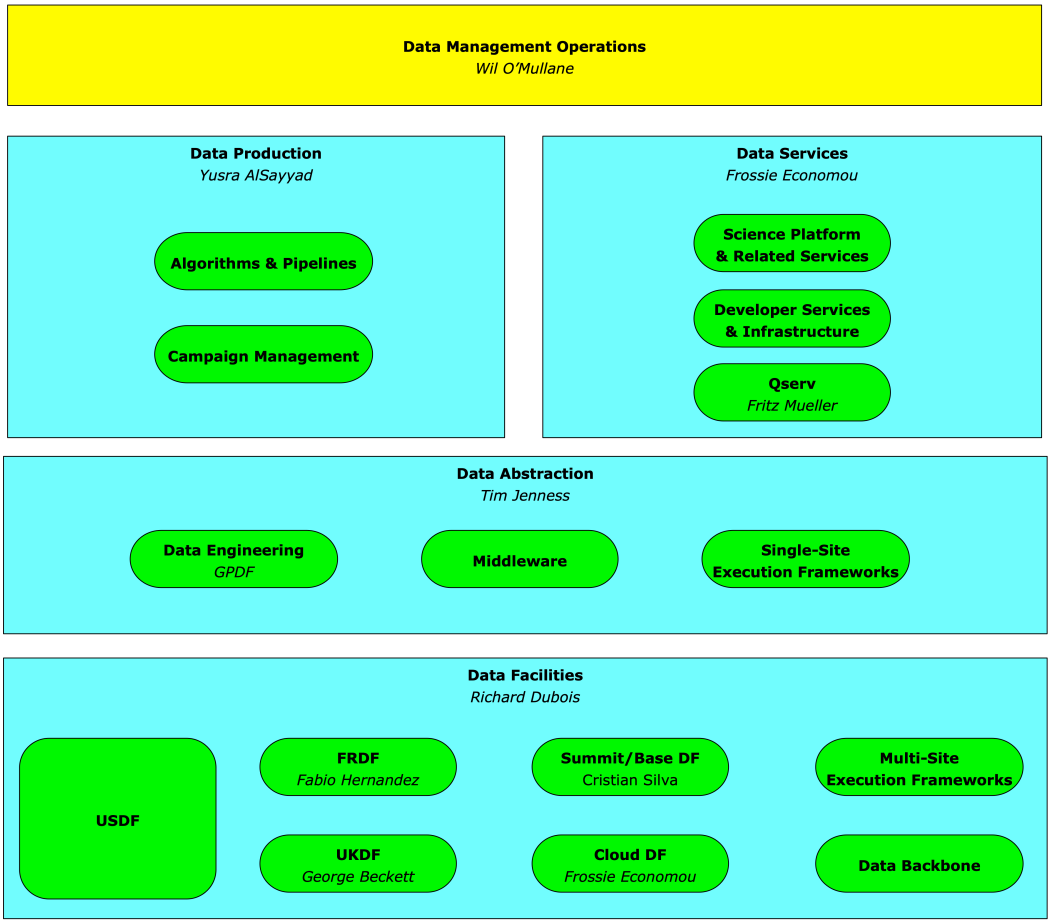

FIGURE 3: Functions in operations of Rubin Data Management.

3.1 DM Science

The DM Science team, led by the DM Lead Scientist, is responsible for defining the vision of the DMS to meet the ten-year scientific goals of the LSST. The team operates at the intersection of DM engineering and the scientific community to ensure the as-built DMS enables transformative science. It works closely with DM engineering to build a system that supports the scientific potential of Rubin/LSST,

while also liaising with the community to facilitate their use of DM deliverables. By learning from the community's experiences, the team integrates this feedback into the continuous evolution and refinement of the system. This collaborative approach helps identify new research opportunities and ensures the DMS evolves with the scientific landscape as fresh insights emerge from LSST data releases.

The DM Science team leads the evaluation of DM performance by tracking KPIs, conducting trend analyses, and overseeing the production of Data Release papers and other key publications to ensure scientific rigor and highlight the transformative potential of LSST data products. The DM Science Team would oversee DM-related science units as they transition from construction to operations, facilitating the integration of their contributions into standard DM operations workflows.

Additionally, DM Science leads joint data processing efforts with other missions, such as Euclid and Roman, fostering collaboration and maximizing the scientific return from multi-mission data.

3.1.1 DM Lead Scientist

The DM Lead Scientist has the ultimate responsibility for ensuring DM initiatives provide solutions that meet the overall LSST science goals. As such, this person leads the definition and understanding of the science goals and deliverables of LSST Data Management and is accountable for communicating these to the DM engineering teams, and working with the DM engineering teams to validate their deliverables.

The DM Lead Scientist reports to the LSST Lead Scientist and is a member of both the DM and Rubin Change Control Boards, as well as the Rubin Operations Science Team. Additionally, the DM Lead Scientist chairs and directs the work of the DM Science Team.

Specific responsibilities and authorities include:

- Communicates with DM science stakeholders (Rubin directors, Scientists and Team, advisory bodies, the science community) to understand their needs and identifies aspects to be satisfied by the DM Department.
- Communicates insights from DM across Rubin departments to inform system-wide decision-making and enhance the understanding of overall system performance.
- Develops, maintains, and articulates the vision of DM products and services responsive to stakeholder needs.

- Communicates the DM System vision to DM stakeholders. Works with the DMAD to communicate and articulate the DM System vision, requirements and especially priorities to the DM team.
- Develops and/or evaluates proposed changes to DM deliverables driven by schedule, budget, or other constraints.
- Validates the science quality of DM deliverables and the capability of all elements of the DM System to achieve LSST science goals with the Data Validation team.
- Serves as Data Management Liaison as requested by Science Collaborations or agrees delegates.
- Defines the science acceptance criteria for DM deliverables (both final and intermediate) and validates that they have been met (Science Validation).
- Delegates authority and responsibility as appropriate to other DM Science Leads
- Represents and speaks for Rubin Data Management.
- Convenes and/or participates in all DM reviews.
- Co-Chairs the DM Executive
- Leads joint data processing efforts with other missions, such as Euclid and Roman,

3.1.2 Community Science

The Community Science team (CST) is responsible for user-facing documentation and tutorials, engagement and learning opportunities, and issue resolution (user support). The CST's primary goal is to facilitate science with the LSST's data products by supporting all users to access and analyze the data using the RSP's data services and tools. This team also prioritizes ingesting feedback from the user community and helping to coordinate updates and improvements. The CST works most closely with the following teams: Algorithms and Pipelines (Data Production), Science Platform and Related Services (Data Services), and Middleware (Data Abstraction).

Specific responsibilities include:

- **Coordinate Support for Science –** Moderate and administer the Rubin Community Forum. Triage issues and coordinate follow-up, ensuring that solutions are reported back. See Graham (RTN-097).

- **Scientific Documentation –** Develop and maintain user-facing scientific documentation, including the ”For Scientists” website, data release technical documentation sites, and RSP user guides.
- **Interact with the Science Community –** Promote the understanding and use of LSST data products, services, and tools at live and virtual events (e.g., seminars, workshops, conferences). Support the Science Collaborations (Graham et al., RTN-118) and the Users Committee (Strauss & the Rubin Science Advisory Council, RDO-051).
- **User-Generated Data Products –** Assist with developing and implementing policies for handling user requests to, e.g., federate algorithms or data products, or access additional compute resources.
- **RSP Science Validation –** Develop and implement processes to validate the scientific utility of the RSP, in coordination with the Users Committee. Follow-up on bug reports and assist with testing new services and tools.

See also Table 3.

3.2 Data services

All services associated with data serving are in this group. As depicted in Figure 3 this includes:

- The Science Platform
- Developer Services Infrastructure
- Qserv advanced Database
- The Engineering Facilities Database

A more complete list of items under may be found in the section 7

3.3 Data Acquisition and Long Haul Networks

After the camera team close the shutter and they read out an image and put header on it. From this point on Data Management take that image process, store and transmit it to the USA..

The hardware and software infrastructure for doing this and for running all telescope control software is part of the Summit facility. The Chile DevOps team delivers and maintains the base and summit facilities (see subsection 4.5).

The team provides networking and machines plus a kubernetes layer ready for deployment of services from data management as well as telescope and site software.

On the summit there are also some bare metal machines which are setup usually with puppet.

This team also controls the more classic IT support for desktops and laptop connections etc.

3.4 Making Data

All services associated with data making and validation are in this group. As depicted in Figure 3 this includes:

- The Science Pipelines code
- Execution of science pipelines to produce data products
  - Alert production
  - Data Release Production

A more complete list of items under may be found in the section 7

There are teams within the area of oversight with specific responsibilities:

- Campaign Management Team: run and look after all data production runs. See Table 8.
- Data Release Pipelines Team: looks after the code for pipelines on short and long timescales. See Table 6.
- Alert Production Team : looks after the prompt and alert product algorithms and execution. See Table 7.
- Validation Team: runs various tests on data to ensure we understand the quality of the products. See Table 9.

3.5 Data Abstraction

Underpinning Data Making and Data Serving is out abstraction of data and services. This includes middleware such as butler and batch production systems etc. But also Prompt Processing execution and Data engineering. It is crucial for our system portability to maintain the abstraction layer.

A comprehensive list is given in section 7.

Some of these require a little more discussion here.

3.5.1 Data Engineering

- Support the metadata translation infrastructure (astro_metadata_translator) and monitor correctness of FITS headers.
- Advise on file formats and file metadata for all systems writing files that are to be archived.
- Support the Felis system for specifying schemas.
- Define the data models for everything in the consolidated database. ("global data model" schema?)
- Write and support code that populates the consolidated database (for example, code that analyzes the EFD and creates the "exposure" and "visit" tables).
- Gregory Dubois-Felsmann is product owner ("Data Scientist")
- Staffing: tiny in construction. 0.5 FTE in ops + fractional GPDF.

3.5.2 Middleware Assumptions

As can be seen in the product list there are a lot of elements to Middleware. A few assumptions are made.

- Assumes butler/Rucio integration is entirely handled by the infrastructure team.
- Assumes database administration is done by the infrastructure team.
- Staffing: 0.5 Andy S; 0.5 new NateP; NateL 0.25; Matthias 0.5; MichelleG 0.5; Kowalik 0.25; at least 0.25 PanDA ongoing person for ctrl_bps_panda.

4 Data facilities and access centers

Hardware underpins all of our operations. This is arranged in three data facilities in US, UK and France as outlined below. We also have two on project Data Access Centers to provide services to the scientific users.

The plan for building up the data facilities is in RTN-021. A more complete list of items under may be found in the section 7

4.1 USDF

The USDF will be the main archive of Rubin data. It performs the daily processing of data including alert generation. It performs 35% of th DRP processing. There is a full description in DMTN-189. User batch will run at the USDF [DMTN-223].

4.2 FrDF

The French Data facility will hold a copy of the Raw data. The FRDF will run 40% of the DRP processing.

4.3 UKDF

The FRDF will run 25% of the DRP processing.

4.4 US DAC

The USDAC is hosted on Google Cloud. Most image data remains at USDF but some catalogs and possibly coadds will be kept on Google. All User files spaces and the RSP will be on google [DMTN-209].

4.5 Chile facilities

There are facilities at the base and the summit in Chile.

4.5.1 Summit Facilities

We maintain a data center on the summit of cerro Pachon. A large part of this is a kubernetes cluster which runs the control system components (CSCs) and the science platform to allow the team access to the images coming of the cameras. There are many other machines for individual control - mostly within the data center though some are physically close to the devices they control. We are responsible for all fibre cabling and networking within the facility to allow interconnection of the equipment.

4.5.2 Base Facilities

Within the NOIRLab base data center we maintain a full DAQ and ancillary machines for testing the control system. This is detailed in .. ITTN-00 The base facility is also where our DWDM connects to the summit and to the LHN . Finally some virtual machines run here for services and backups of services in the US such as email.

4.5.3 Chile DAC

The Chilean Data Access Center will be built after operations commences. Some discussions are still pending on its exact shape see LDM-572. This will be hosted in the base data center.

5 Project Controls

DM operations tracks work and milestones in Jira following RTN-005.

Risk management folows the Operations risk management plan [RDO-71].

Security is covered in O'Mullane et al. (RTN-030).

Disaster recovery is civered in various documents:

- ITTN-058 covers Disaster Recovery for Infrastructure Support Devices
- ITTN-057 covers Disaster Recovery for Computing
- ITTN-056 covers Disaster Recovery for the Network

5.1 Work Breakdown Structure

Table Table 1 gives the WBS structure for DM in operaitons.

Table 1: WBS elements for Rubin Observatory Data Management Operations

WBS	Department	Team
3.1	Data Management Operations	RDM Management
3.2	Data Management Operations	US Data Facility
3.3	Data Management Operations	France Data Facility
3.4	Data Management Operations	UK Data Facility
3.5	Data Management Operations	Chilean DevOps
3.6	Data Management Operations	Pipeline Middleware
3.7	Data Management Operations	Data Engineering
3.8	Data Management Operations	Algorithms & Pipelines
3.9	Data Management Operations	Campaign Management
3.10	Data Management Operations	Service Quality and Reliability Engineering
3.11	Data Management Operations	Qserv
3.12	Data Management Operations	Build Engineering
3.13	Data Management Operations	Community Science
3.14	Data Management Operations	Data Validation

6 Roles and Responabilities

Table 2: Management roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.1a	Associate Director for Data Management Operations	The AD of the Data Management Operations Department is one of the principal leaders of the Rubin Observatory operations phase. This position requires a Ph.D. level astronomer with extensive astronomical survey and science management experience, and reports directly to the Rubin Observatory Director. The primary responsibilities of this position include the management of the Data Management Operations Department (including budget and planning for this WBS element), participation in the leadership of Rubin Observatory survey, and coordination with other Rubin Observatory Departments. The AD for Data Management Operations also has overall responsibility and authority for safely running the Rubin Observatory Data Facilities (DF) including the generation of prompt data products (alerts) and the annual data release processing. This person will supervise a technical staff that will be responsible for all aspects of data processing, preparation of data products, archiving, and operation of the Chilean, French and UK DACs/DFs, as well as the US DF. They will be responsible for coordinating with project level Contract Management and Supplier Management when dealing with issues of business impact, and accountable for ensuring a disaster recovery plan is effective and able to be invoked. The AD of Data Management Operations is also responsible for supervising the data flow from the Recinto to the USDF.
3.1b.1	Data Management Operations Deputy Manager - NOIRLab	Assist the AD of Data Management Operations in all aspects of the ongoing project. The deputy manager will be enabled to act on behalf of the AD in any situation.
3.1b.2	Data Management Operations Deputy Manager - SLAC	Assist the AD of Data Management Operations in all aspects of the ongoing project. The deputy manager will be enabled to act on behalf of the AD in any situation.

3.1c.2	Data Management Operations Advisor - US DF	Each Rubin Observatory Data Facility (US, French and UK) has an advisory role to the AD for Data Management Operations in terms of execution across the data facilities. The US DF Advisor role is held by the US DF Lead; this person is responsible for Data Facilities oversight, analgous to the other oversight areas in the department.
3.1c.3	Data Management Operations Advisor - Fr DF	Each Rubin Observatory Data Facility (US, French and UK) has an advisory role to the AD for Data Management Operations in terms of execution across the data facilities.
3.1c.4	Data Management Operations Advisor - UK DF	Each Rubin Observatory Data Facility (US, French and UK) has an advisory role to the AD for Data Management Operations in terms of execution across the data facilities.
3.1d.1	Data Abstraction Oversight	Oversees the Pipeline Middleware and Data Engineering Teams, functionally supervising the leaders of those teams and reporting on their activity to the AD for RDM.
3.1d.2	Data Production Oversight	Oversees the Algorithms and Pipelines and Campaign Management Teams, functionally supervising the leaders of those teams and reporting on their activity to the AD for RDM.
3.1d.3	Data Services Oversight	Oversees the SQuaRE and Advanced Databases Teams, functionally supervising the leaders of those teams and reporting on their activity to the AD for RDM.
3.1d.4	Data Acquisition Oversight	Oversees the SQuaRE and Advanced Databases Teams, functionally supervising the leaders of those teams and reporting on their activity to the AD for RDM.
3.1d.5	Data Production Oversight - SLAC	Oversees the Algorithms and Pipelines and Campaign Management Teams, functionally supervising the leaders of those teams and reporting on their activity to the AD for RDM.
3.1d.6	DM Lead Scientist	eads the understanding and evaluation of DM performance to ensure LSST data products and services enable transformative science, and shepherds key papers and investigations showcasing their potential.
3.1d.7	Data Production Oversight - UW	Oversees the Algorithms and Pipelines and Campaign Management Teams, functionally supervising the leaders of those teams and reporting on their activity to the AD for RDM.

3.1e	NCSA Management Support	Provide Project support at NCSA for the NCSA team

6.1 DM Science Roles

Table 3: DM Science Roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.13		Support the community's use of the survey data products, science pipelines, and data access services (e.g., Rubin Science Platform). Ingest feedback needed to ensure scientific productivity.
3.13a	Lead Community Scientist	Serves as strategic and tactical lead of the Community Science team, and the primary interface between the user community and the operations team (e.g. by facilitating the Users Committee). Oversees user training and support, documentation, implementation of the processes used for evaluating applications for computing time and special survey cadences. Serves as responsible lead of Science Communication, with sign-off on data product documentation readiness (recommending to the AD of System Performance when the data product documentation is ready for a release). Reports to the AD of System Performance. This is a relatively senior role to be filled by a scientist with the respect and recognition of the community.
3.13b.6	Deputy Lead Community Scientist	Assists with leadership of the CST and assumes the lead role when needed. Maintains a high level of expertise with CST policies, workflows, activities, and interfaces. As a Community Scientist, supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials), and collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. Has scientific experience and expertise in at least one of (or spanning) the Rubin Observatory science pillars.

3.13b	Community Scientist - NOIRLab Astronomer	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have significant depth of experience and expertise spanning the Rubin Observatory science pillars (and especially the transient universe, solar system, and Milky Way). The Astronomer role is filled by a scientist on the NOIRLab Astronomer track, and includes 50% science time.
3.13b.1	Community Scientist Engagement PD-NOIRLab	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the transient universe, solar system, and Milky Way). This role is to be filled by a postdoc and comes with 50% science time.
3.13b.2	Community Scientist - NOIRLab Scientist	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the transient universe, solar system, and Milky Way).
3.13b.3	Community Scientist for Chile - NOIRLab Scientist	Supports the Chilean scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by Chilean scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the transient universe and Milky Way, the two most active science pillars in Chile).

3.13b.4	Surge Community Scientist analysis priority II-1 - NOIRLab Scientist	Supports the Chilean scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by Chilean scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the transient universe and Milky Way, the two most active science pillars in Chile).
3.13b.5	Surge Community Scientist analysis priority II-1 - NOIRLab Scientist	Supports the Chilean scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by Chilean scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the transient universe and Milky Way, the two most active science pillars in Chile).
3.13c.1	Community Scientist - SLAC Ops	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the study of dark matter and dark energy).
3.13c.1	Community Scientist - SLAC Ops	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the study of dark matter and dark energy).
3.13c.2	Surge Community Scientist - SLAC	Additional effort to help prepare for DP1 and DP2, cover potential pre-ops staff turnover. 50% science time to cement connection to DESC and enable recruitment.

3.13c.3	Community Scientist - SLAC Res	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the study of dark matter and dark energy).
3.13c.4	Community Scientist - Fermilab Ops	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the study of dark matter and dark energy).
3.13c.5	Community Scientist - Fermilab Res	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These generalists should have experience and expertise spanning the Rubin Observatory science pillars (and especially the study of dark matter and dark energy).
3.13d	Community Scientist - Secondments	Supports the broad international scientific community of users through various communication channels (e.g., online Q&A forums, workshops, tutorials). Collaborates closely with staff in Observatory Operations and Data Production to diagnose and respond to issues identified by the scientific community. These scientists should have experience and expertise that collectively span the Rubin Observatory science pillars, and can be postdocs circulating through NOIRLab and SLAC on secondments. Staffing profile gives an approximate target team size.

3.13e.1	Community Scientist (Citizen Science) - SLAC	Responsible for ensuring that citizen science programs enhance the scientific performance of the Rubin Observatory. Provides support for members of the science community to set up, execute, and retrieve results from citizen science programs that are an integral part of their Rubin-based research. Evaluates and logs citizen science inquiries and Rubin Observatory-Zooniverse integration troubleshooting. Participates in the Zooniverse framework technology refresh cycle that typically occurs every 3-5 years. Within the Rubin Citizen Science Working Group, works with the EPO Scientist, Citizen Science Developer and Citizen Science Advisor to guide the development of citizen science programs. Leverages other Community Scientists and Documentation staff to help with the curation of User Generated data products (including their SDQA) so as to render them suitable for EPO programs at the EDC. Responsible for quality assurance of the EPO Data Products pipeline into the EDC and the scientific validity of EPO deliverables. Works with the EPO Scientist to select and develop citizen science projects that require customizations not provided via the Zooniverse Project Builder Tool.

3.13e.2	Community Scientist (Citizen Science) - SLAC Surge	Responsible for ensuring that citizen science programs enhance the scientific performance of the Rubin Observatory. Provides support for members of the science community to set up, execute, and retrieve results from citizen science programs that are an integral part of their Rubin-based research. Evaluates and logs citizen science inquiries and Rubin Observatory-Zooniverse integration troubleshooting. Participates in the Zooniverse framework technology refresh cycle that typically occurs every 3-5 years. Within the Rubin Citizen Science Working Group, works with the EPO Scientist, Citizen Science Developer and Citizen Science Advisor to guide the development of citizen science programs. Leverages other Community Scientists and Documentation staff to help with the curation of User Generated data products (including their SDQA) so as to render them suitable for EPO programs at the EDC. Responsible for quality assurance of the EPO Data Products pipeline into the EDC and the scientific validity of EPO deliverables. Works with the EPO Scientist to select and develop citizen science projects that require customizations not provided via the Zooniverse Project Builder Tool.
3.13f	Community Documentation - NOIRLab	Coordinates and participates in the delivery of user-facing scientific documentation related to the Rubin Observatory data products, and software, as well as scientific information on the Rubin Observatory website. Oversees and makes decisions on user-facing documentation tools and methods, with approval from the Lead Community Scientist. Reports to the Community Scientist.
3.13g	Community Documentation - SLAC	Coordinates and participates in the delivery of user-facing scientific documentation related to the Rubin Observatory data products, and software, as well as scientific information on the Rubin Observatory website. Oversees and makes decisions on user-facing documentation tools and methods, with approval from the Lead Community Scientist. Reports to the Community Scientist.

3.13g	Community Documentation - SLAC	Coordinates and participates in the delivery of user-facing scientific documentation related to the Rubin Observatory data products, and software, as well as scientific information on the Rubin Observatory website. Oversees and makes decisions on user-facing documentation tools and methods, with approval from the Lead Community Scientist. Reports to the Community Scientist.

6.2 Data Serving Roles

Table 4: SQuARE roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.10a	Technical Lead/Manager	Responsible for technical leadership and management of the Service Quality and Reliability Engineering Team. This includes running stand ups and looking after budgets and staff issues as well as making technical calls where decisions are needed. The technical lead is responsible overall for the architecture of the team's services and for ensuring it is fit for purpose for the observatory's evolving needs. They also represent the team's work both inside the organization and to the astronomical and computing technical community.

3.10b.1	Senior Full Stack and Documentation Engineer - NOIRLab	A Senior Full-Stack Engineer is a DevOps Engineer who is versed in architecture and implementation of both backend and frontend architectures. They are able to synthesize requirements, propose system architectures and independently implement services. They have advanced skills in DevOps engineering, including Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service. A Documentation Engineer is well versed in architecting effective ways to support documentation oriented workflows such as documentation continuous delivery systems and integration with communication platforms. They have advanced skills in service implementation and deployment, familiarity with documentation infrastructure libraries such as Sphinx, and best practices in software documentation, including code-level, package-level and user guides.
3.10b.2	Security Architect / Senior DevOps Engineer - NOIRLab	A Security Architect is a software engineer with advanced expertise in designing and building software services with particular regard to security concerns such as authentication & authorisation, hardening, auditability, penetration testing and dependency management. A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service.
3.10c.1	Front End Engineer / Senior Front End Engineer - NOIRLab	Front-end engineers with strong javascript skills, web services architecture, user interface design and astronomical search and visualisation to focus on the Science Platform portal. At least one of these FTEs needs to be at IPAC at a senior engineer level to reflect our current technical investment in Firefly and coordinate effort appropriately in conjunction with other IPAC Firefly development. An appropriately skilled FTE may be found elsewhere or may be added to an IPAC subcontract if available

3.10c.2	Front End Engineer / Senior Front End Engineer - IPAC	Front-end engineers with strong javascript skills, web services architecture, user interface design and astronomical search and visualisation to focus on the Science Platform portal. At least one of these FTEs needs to be at IPAC at a senior engineer level to reflect our current technical investment in Firefly and coordinate effort appropriately in conjunction with other IPAC Firefly development. An appropriately skilled FTE may be found elsewhere or may be added to an IPAC subcontract if available
3.10d.1	Science Platform & Production Services Engineer	A Science Platform and Production Services Engineer is responsible for identifying and resolving issues with production services, including user-facing services such as the Science Platform as well as facility services (such as deployments of the Science Platform at the telescope summit). They are also responsible for evolving services on the basis of rapidly changing user demand, for example the JupyterLab-based component of the Science Platform. They have strong software engineering skills including coding, testing and service deployment and can perform technical work in an independent manner.
3.10d.2	Services Architect / Senior DevOps Engineer	A Services Architect is a software engineer with advanced expertise in designing and building software services with particular regard to scalability, performance, deployment infrastructure and interface design. They are able to synthesize requirements, propose system architectures and independently implement services. A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service.
3.10d.3	Intern	Intern

3.10e.1	Senior Scientific Programmer / Data Exploration Specialist	A Senior Scientific Programmer has deep domain expertise and is adept in capturing and implementing data analysis solutions. Their scientific background allows them to anticipate user data exploration needs and other requirements and to effectively communicate them to other engineers on their team. A Data Exploration Specialist communicates data exploration needs to the engineers, documents and develops tools, demonstrates how to achieve scientific goals with the tools provided. This would explicitly include technical consultations to the Community Science Team and EPO scientists. Their scientific background allows them to translate the technical needs of the users of services (external and internal) into an engineering request, as well as functioning as liaison to other interrelated systems (in particular Middleware and Infrastructure) to which Science Platform services have a dependence.
3.10e.2	Senior Devops Engineer / Data Engineer - NOIRLab	A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service. A Data Engineer is a software engineer with the ability to model and abstract data flow and representation, as well as design and implement appropriate systems for the effective curation and visualisation of particular kinds of data (eg. time series). A Data Exploration Specialist communicates data exploration needs to the engineers, documents and develops tools, demonstrates how to achieve scientific goals with the tools provided. This would explicitly include technical consultations to the Community Science Team and EPO scientists. Their scientific background allows them to translate the technical needs of the users of services (external and internal) into an engineering request, as well as functioning as liaison to other interrelated systems (in particular Middleware and Infrastructure) to which Science Platform services have a dependence.

3.10e.3	Senior Devops Engineer / Data Engineer - SLAC	A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service. A Data Engineer is a software engineer with the ability to model and abstract data flow and representation, as well as design and implement appropriate systems for the effective curation and visualisation of particular kinds of data (eg. time series). A Data Exploration Specialist communicates data exploration needs to the engineers, documents and develops tools, demonstrates how to achieve scientific goals with the tools provided. This would explicitly include technical consultations to the Community Science Team and EPO scientists. Their scientific background allows them to translate the technical needs of the users of services (external and internal) into an engineering request, as well as functioning as liaison to other interrelated systems (in particular Middleware and Infrastructure) to which Science Platform services have a dependence.

Table 5: Qserv roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.11a	Qserv Lead	Coordinates development efforts for Qserv (coordinating efforts with other teams, balancing priorities, facilitating descisions, detailed work assignements, reporting, etc.)
3.11b	Database Engineer (Qserv) - SLAC	Develops, maintains, and implements the science Databases e.g. QSERV database, data butler, Prompt Products Database. May also work on other middleware as needed.

3.11c	Qserv Dev/Ops Software Engineer - IN2P3	Develops, maintains, and implements DF software, including: QSERV database, data butler, DAX, Alert Filtering Service, orchestration software, workflow software, data backbone software, integration testing framework, authentication services, pipeline construction tools, operational fabric codes, logging, messaging, monitoring and health and status software, hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites.

6.3 Data Production Roles

Table 6: Data Production roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.6a	Pipeline Middleware Lead	Organizes the software maintenance effort and assigns work in a way that provides for continuity of maintenance for all Rubin Observatory maintained software. Is primarily responsible for further defining and enforcing software engineering rules related to maintenance, including maintenance of documentation, correct security practices, testing, and other aspects of delivery of a complete change set. Ensures that software tasks are consistent with authorized changes. Carries share of maintenance load. Participates in reviews.
3.6b.1	Pipeline Middleware Engineer - NOIRLab	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.6b.2	Pipeline Middleware Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

Table 7: Algorithm and Pipeline roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.8a	Algorithms & Pipelines Lead	Responsible for the leadership and coordination of the Data Production Team, the scientific integrity of Alert Production and Data Releases, and interaction and coordination with the Lead Community Scientist, Lead Scheduler Scientist, and the Lead Production Scientist. This position requires a Ph.D. level astronomer with extensive astronomical survey and software experience, or a software engineer with extensive astronomical experience.
3.8a	Algorithms & Pipelines Lead	Responsible for the leadership and coordination of the Data Production Team, the scientific integrity of Alert Production and Data Releases, and interaction and coordination with the Lead Community Scientist, Lead Scheduler Scientist, and the Lead Production Scientist. This position requires a Ph.D. level astronomer with extensive astronomical survey and software experience, or a software engineer with extensive astronomical experience.
3.8b	Alert Production Pipeline Group Leader	Applying extensive astronomical knowledge, including solar system, explosive transients, and time-domain surveys in general, and Rubin Observatory software experience, this role acts as product owner for the prompt processing pipelines and oversees the day-to-day work of the Alert Production Pipeline Scientists. Recommends changes to Alert Production Pipelines and supports or rejects software changes based on scientific validation of new algorithms and an understanding of their impact on required computational resources. This position requires a Ph.D. level astronomer with extensive astronomical survey and software experience or a software engineer with extensive astronomical expertise.
3.8c	Lead Alert Production Algorithms Scientist	This role provides leadership for the algorithmic development of the prompt processing pipelines, such as image differencing and template generation. This position requires a Ph.D. level astronomer with extensive astronomical survey and software experience or a software engineer with extensive astronomical expertise.

3.8d.1	Alert Production Pipeline Scientist - NOIRLab/UW	This role combines an understanding of one or more specific prompt processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Prompt Processing Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive time-domain survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Alert Production Pipeline Group Leader.
3.8d.2	Alert Production Pipeline Scientist - SLAC	This role combines an understanding of one or more specific prompt processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Prompt Processing Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive time-domain survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Alert Production Pipeline Group Leader.
3.8d.3	Alert Production Pipeline Scientist - NOIRLab/IN2P3	This role combines an understanding of one or more specific prompt processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Prompt Processing Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive time-domain survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Alert Production Pipeline Group Leader.

3.8e	Alert Production Pipeline Consultant	Supports and reports to the Alert Production Pipeline Group Leader. The Consultant position is a senior software position filled by fractions of individuals with deep and intimate knowledge of the Rubin Observatory Data Management system, presumably from the construction period. Guidance for the solar system processing pipeline.
3.8f	AVS Oversight Liaison	A member of the Alert Production Pipeline Group should work closely with the AVS Engineers to ensure proper integration of the algorithms and correct application of any data screening.
3.8g	Data Release Pipeline Group Leader	Applying extensive astronomical knowledge of all key Rubin Observatory science cases (including dark energy, galaxies, and stars), wide-field astronomical surveys, and Rubin Observatory software, this role acts as product owner for the data release processing pipelines and oversees the day-to-day work of the Data Release Pipeline Scientists. Recommends changes to Data Release Production Pipelines and supports or rejects software changes based on scientific validation of new algorithms and an understanding of their impact on required computational resources. Defines, develops, and maintains the Rubin Observatory scientific processing pipelines' overall architecture, advising Pipeline Scientists to ensure that the overall Rubin Observatory Science Pipelines form a coherent whole, interfacing with the Middleware Team. This position requires a Ph.D. level astronomer with extensive astronomical survey and software experience or a software engineer with extensive astronomical expertise. Expert in software architecture with expertise in scientific software design and the Rubin Observatory software system preferred. Reports to the Lead of Algorithms and Pipelines.

3.8g	Data Release Pipeline Group Leader	Applying extensive astronomical knowledge of all key Rubin Observatory science cases (including dark energy, galaxies, and stars), wide-field astronomical surveys, and Rubin Observatory software, this role acts as product owner for the data release processing pipelines and oversees the day-to-day work of the Data Release Pipeline Scientists. Recommends changes to Data Release Production Pipelines and supports or rejects software changes based on scientific validation of new algorithms and an understanding of their impact on required computational resources. Defines, develops, and maintains the Rubin Observatory scientific processing pipelines' overall architecture, advising Pipeline Scientists to ensure that the overall Rubin Observatory Science Pipelines form a coherent whole, interfacing with the Middleware Team. This position requires a Ph.D. level astronomer with extensive astronomical survey and software experience or a software engineer with extensive astronomical expertise. Expert in software architecture with expertise in scientific software design and the Rubin Observatory software system preferred. Reports to the Lead of Algorithms and Pipelines.
3.8h.1	Data Release Pipeline Scientist - NOIRLab/Princeton	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.

3.8h.2	Data Release Pipeline Scientist - SLAC	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.
3.8h.2	Data Release Pipeline Scientist - SLAC	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.
3.8h.3	Surge Data Release Pipeline Scientist - SLAC	Additional effort to ensure high performance of the weak lensing and PSF modeling parts of the DRP pipeline.

3.8h.4	Surge Data Release Pipeline Scientist - NOIRLab/Princeton	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.
3.8h.5	Data Release Pipeline Scientist - NOIRLab/-Sozen	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.
3.8i	Science Pipelines Release Engineer	Maintain and improve the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). Flag features for inclusion in software releases needed for data releases. Write release notes. (This role COULD also support the observatory software builds which could potentially remain different to the Data Management Operations builds)

3.8j	Calibration Scientist - Independent	Together with the Calibration Support Scientist at the summit, ensures that data is available to enable proper astrometric and photometric calibration of Rubin Observatory data as part of regular pipeline processing. The Calibration Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience: it is desirable for this position to be filled by a person who contributed to the construction of the Calibration Products Production pipeline.
3.8k.1	Calibration Group Leader - NOIRLab	Ensures that data is available to enable proper astrometric and photometric calibration of Rubin Observatory data as part of regular pipeline processing. This role combines an understanding of one or more specific data release processing science use cases with software engineering expertise to modify, extend, and update the first steps of both the prompt processing and data release pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience. Prefer someone who contributed to the construction of the Calibration Products Production Pipeline
3.8k.2	Calibration Group Leader - SLAC	Ensures that data is available to enable proper astrometric and photometric calibration of Rubin Observatory data as part of regular pipeline processing. This role combines an understanding of one or more specific data release processing science use cases with software engineering expertise to modify, extend, and update the first steps of both the prompt processing and data release pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience. Prefer someone who contributed to the construction of the Calibration Products Production Pipeline

3.8k.2	Calibration Group Leader - SLAC	Ensures that data is available to enable proper astrometric and photometric calibration of Rubin Observatory data as part of regular pipeline processing. This role combines an understanding of one or more specific data release processing science use cases with software engineering expertise to modify, extend, and update the first steps of both the prompt processing and data release pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience. Prefer someone who contributed to the construction of the Calibration Products Production Pipeline
3.8l	Calibration Scientist - SLAC	Ensures that data is available to enable proper astrometric and photometric calibration of Rubin Observatory data as part of regular pipeline processing. This role combines an understanding of one or more specific data release processing science use cases with software engineering expertise to modify, extend, and update the first steps of both the prompt processing and data release pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience. Prefer someone who contributed to the construction of the DM Calibration Products Production Pipeline or from the construction era Camera Team
3.8l	Calibration Scientist - SLAC	Ensures that data is available to enable proper astrometric and photometric calibration of Rubin Observatory data as part of regular pipeline processing. This role combines an understanding of one or more specific data release processing science use cases with software engineering expertise to modify, extend, and update the first steps of both the prompt processing and data release pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience. Prefer someone who contributed to the construction of the DM Calibration Products Production Pipeline or from the construction era Camera Team

3.8l.2	Surge Calibration Scientist - SLAC	Additional support for the ISR pipeline tasks. Could be a postdoc with 50% science time used to investigate commissioning data and further boost the ops ISR pipeline development.
3.8m	Calibration Consultant	Advises and reports to the Calibration Group Leader. The Consultant position is a senior position filled by fractions of individuals with deep and intimate knowledge of the Rubin Observatory Data Management system, presumably from the construction period.
3.8h.6	Opportunity Rubin/Euclid Joint Processing	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.
3.8h.8	Opportunity Rubin/Euclid Joint Processing - Surge	This role combines an understanding of one or more specific data release processing processing science use cases with software engineering expertise and an understanding of the Rubin Observatory Science Pipelines to work in conjunction with the Science Software Engineering Group to modify, extend, and update the Data Release Pipelines in response to emergent scientific needs, community requests, and bug reports. This role requires a Ph.D. level astronomer with extensive astronomical survey and software development experience, or a software engineer with extensive astronomical experience. Reports to the Data Release Pipeline Group Leader.
3.8h.7	Opportunity Rubin/Euclid Joint Processing - Lead	Local Advisor

Table 8: Campaign Management roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.9a	Campaign Management Lead	Lead the Campaign Management Team. Coordinate scheduling and training. Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the US DF Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9a	Campaign Management Lead	Lead the Campaign Management Team. Coordinate scheduling and training. Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the US DF Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.2	Processing Scientist - SLAC Ops	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.

3.9b.2	Processing Scientist - SLAC Ops	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.6	Processing Scientist - SLAC Research	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.7	Processing Scientist - Fermilab Ops	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.

3.9b.7	Processing Scientist - Fermilab Ops	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.8	Processing Scientist - Fermilab Research	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.1	Processing Scientist - NOIRLab/UW	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.

3.9b.5	Processing Scientist - NOIRLab/NCSCA	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.3	Processing Scientist - IN2P3	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9b.4	Processing Scientist - UK	Perform day to day technical operation of data processing campaigns, including Alert Production, Data Release Production, Calibration, and other campaigns. Diagnose and address processing deficiencies, bottlenecks, and failure modes. Coordinate with the V&V team in testing and implementing the campaign strategies and finalizing the campaign configurations. Coordinate with the Workflow/load Management Engineer and the Infrastructure Group in troubleshooting infrastructure failures. This may require 7 days per week coverage.
3.9c.2	Campaign Management Developer - SLAC	To be written!
3.9c.2	Campaign Management Developer - SLAC	To be written!

3.9c.3	Campaign Management Developer - NOIRLab/UW	Campaign Tooling Engineer

Table 9: V&V Roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.14		Verify and validate the survey data products.
3.14a	Lead Verification and Validation Scientist	Responsible for driving the overall vision of V&V activities including test automation strategy and system tests. Leads the specification, development and execution of all verification, validation and quality assurance of the Rubin Observatory data products. Responsible for evaluating, understanding and quantifying the survey systematics. Leads the V&V team, reports to the AD for System Performance.
3.14b.1	Production Scientist - Fermilab Ops	Responsible for processing and database ingestion of Prompt (Alert) Data Products. Expert in the technical operation of the Alerts pipeline. Address bottlenecks, failure modes. Responsible for processing and database ingestion of Batch (DRP) Data Products. This includes responsibility for: acting as the Scientific Code Liaison, hardware and software deployment, oversight and responsibility for processing execution, prompt SDQA and response, alert filtering service operations, and external (community) broker operations.
3.14b.1	Production Scientist - Fermilab Ops	Responsible for processing and database ingestion of Prompt (Alert) Data Products. Expert in the technical operation of the Alerts pipeline. Address bottlenecks, failure modes. Responsible for processing and database ingestion of Batch (DRP) Data Products. This includes responsibility for: acting as the Scientific Code Liaison, hardware and software deployment, oversight and responsibility for processing execution, prompt SDQA and response, alert filtering service operations, and external (community) broker operations.

3.14b.2	Production Scientist - IN2P3	Responsible for processing and database ingestion of Prompt (Alert) Data Products. Expert in the technical operation of the Alerts pipeline. Address bottlenecks, failure modes. Responsible for processing and database ingestion of Batch (DRP) Data Products. This includes responsibility for: acting as the Scientific Code Liaison, hardware and software deployment, oversight and responsibility for processing execution, prompt SDQA and response, alert filtering service operations, and external (community) broker operations.
3.14b.3	Production Scientist - UK	Responsible for processing and database ingestion of Prompt (Alert) Data Products. Expert in the technical operation of the Alerts pipeline. Address bottlenecks, failure modes. Responsible for processing and database ingestion of Batch (DRP) Data Products. This includes responsibility for: acting as the Scientific Code Liaison, hardware and software deployment, oversight and responsibility for processing execution, prompt SDQA and response, alert filtering service operations, and external (community) broker operations.
3.14b.4	Production Scientist - Fermilab Research	Responsible for processing and database ingestion of Prompt (Alert) Data Products. Expert in the technical operation of the Alerts pipeline. Address bottlenecks, failure modes. Responsible for processing and database ingestion of Batch (DRP) Data Products. This includes responsibility for: acting as the Scientific Code Liaison, hardware and software deployment, oversight and responsibility for processing execution, prompt SDQA and response, alert filtering service operations, and external (community) broker operations.
3.14c	SDQA Scientist for Alert Production	Evolves, documents, and verifies the SDQA analysis for the prompt data products (Alert Production). This position requires a Ph.D. level astronomer with astronomical survey experience. The SDQA scientist works with the Alert Production group.
3.14d.1	SDQA Scientist for Data Releases - Princeton	Evolves, documents, and verifies the SDQA analysis for the annual Data Release data products. This position requires a Ph.D. level astronomer with astronomical survey experience. The SDQA scientist works with the Data Release group.

3.14d.2	SDQA Scientist for Data Releases - UK	Evolves, documents, and verifies the SDQA analysis for the annual Data Release data products. This position requires a Ph.D. level astronomer with astronomical survey experience. The SDQA scientist works with the Data Release group.
3.14d.3	SDQA Scientist for Data Releases - SLAC	Evolves, documents, and verifies the SDQA analysis for the annual Data Release data products. This position requires a Ph.D. level astronomer with astronomical survey experience. The SDQA scientist works with the Data Release group.
3.14d.4	SDQA Scientist for Data Releases - NOIRLab	Evolves, documents, and verifies the SDQA analysis for the annual Data Release data products. This position requires a Ph.D. level astronomer with astronomical survey experience. The SDQA scientist works with the Data Release group.
3.14e.1	Data Release Systematics Scientist - BNL Ops	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.
3.14e.1	Data Release Systematics Scientist - BNL Ops	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.

3.14e.2	Data Release Systematics Scientist - NOIRLab	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on non-dark energy science (including solar system, transient universe and Milky Way science). These positions will contribute to documentation for Data Release data products.
3.14e.3	Data Release Systematics Scientist - BNL Res	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.
3.14e.4	Data Release Systematics Scientist - SLAC Ops	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.

3.14e.5	Data Release Systematics Scientist - SLAC Res	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.
3.14e.6	Data Release Systematics Scientist - Fermilab Ops	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.
3.14e.7	Data Release Systematics Scientist - Fermilab Res	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.

3.14e.8	Surge Data Release Systematics Scientist - UWisc	The Data Release Systematics Scientist position requires a Ph.D. level astronomer with extensive astronomical survey and Rubin Observatory software experience, or a software engineer with extensive astronomical and Rubin Observatory experience. Systematics Scientists are responsible for conducting analyses of image and catalog data needed to evaluate, understand, and quantify the systematics, with focus on dark energy science. These positions will contribute to documentation for Data Release data products.
3.14f	Data Visualization Engineer	Leads and consults on data visualization system across all departments. Documents and develops data visualization tools, demonstrates how to achieve scientific goals with the tools provided, produces example visualizations. Includes technical support in data visualization to the Community and EPO scientists. These are specialist software engineers with science backgrounds who can cater to the scientific needs of the users, and are deployed to the REO Outreach, RPF Community Science, and other operatins teams by RPF Mgmt.

6.4 Data Abstraction Roles

Table 10: Data Engineering roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.7a	Data Scientist	Hold project history on data models etc and guide VO developments
3.7a	Data Scientist	Hold project history on data models etc and guide VO developments
3.7b.2	Data Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

3.7b.2	Data Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.7b.3	Data Engineer - NOIRLab	TBD

Table 11: Pipeline Middleware roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.6a	Pipeline Middleware Lead	Organizes the software maintenance effort and assigns work in a way that provides for continuity of maintenance for all Rubin Observatory maintained software. Is primarily responsible for further defining and enforcing software engineering rules related to maintenance, including maintenance of documentation, correct security practices, testing, and other aspects of delivery of a complete change set. Ensures that software tasks are consistent with authorized changes. Carries share of maintenance load. Participates in reviews.
3.6b.1	Pipeline Middleware Engineer - NOIRLab	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.6b.2	Pipeline Middleware Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.6b.3	Pipeline Middleware Engineer - NOIRLab/NCSA	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

3.6b.4	Pipeline Middleware Engineer - NOIRLab/Princeton	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/-workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

6.5 Data Facility Roles

Table 12: Chile Summit and Base Facility roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.5a	Chilean DevOps Technical Lead/Manager	Responsible for technical leadership and management of the Chilean DevOps Support Team, including planning and overseeing the installation, operation and maintenance of all Chilean computing hardware. This includes all summit hardware, networks and cabling. The summit systems are run as infrastructure through service deployment; the Chilean devops team must maintain a deployment ready layer (foreman, puppet, kubernetes) for software teams to work with. This also includes maintaining the camera test stands in Chile and in Tucson in a similar as that for the summit. Interface with NOIRLab COS-IT to coordinate delivered IT services such as helpdesk and network support. Work with the I&S Team's DF/DACs Technical Coordinator to build the Chilean DAC into the Rubin DAC Network.
3.5b.1	Chilean DevOps Engineer	Responsible for the installation, operation and maintenance of all Chilean and test stand (Tucson) computing hardware. This includes guidance on technical decisions for technology both in terms of hardware and software. This may require negotiation/persuasion of COS/IT to support desired Rubin technology in the future and open mindedness to offered solutions from NOIRlab. Training and inclusion of less experienced staff is an essential part of this role.

3.5b.2	Surge Chilean DevOps Engineer Cover	Responsible for the installation, operation and maintenance of all Chilean and test stand (Tucson) computing hardware. This includes guidance on technical decisions for technology both in terms of hardware and software. This may require negotiation/persuasion of COS/IT to support desired Rubin technology in the future and open mindedness to offered solutions from NOIRlab. Training and inclusion of less experienced staff is an essential part of this role.
3.5c	DevOps Security Analyst	Responsible for the analysis of logs, threats and develop local policies to anticipate and protect against potential threats. The analyst should also be responsible to create and maintain protocols, processes, and procedures to guard against cyber threats, unauthorized access, and data breaches, all under the DevOps environment of Rubin observatory

Table 13: USDF roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.2a	US Data Facility Lead - Res	Provides management and oversight for the US Data Facility. Provides for evolution of service architecture and supporting ITC. Responsible for design and evolution of the US DF and its interactions with the French and UK Data Facilities, and the Chilean and other DACs.
3.2a.2	US Data Facility Lead - Ops	Provides management and oversight for the US Data Facility. Provides for evolution of service architecture and supporting ITC. Responsible for design and evolution of the US DF and its interactions with the French and UK Data Facilities, and the Chilean and other DACs.
3.2a.2	US Data Facility Lead - Ops	Provides management and oversight for the US Data Facility. Provides for evolution of service architecture and supporting ITC. Responsible for design and evolution of the US DF and its interactions with the French and UK Data Facilities, and the Chilean and other DACs.

3.2a.3	US Data Facility Deputy Lead - Res	Provides support for the USDF Lead in management and oversight for the US Data Facility, evolution of service architecture, ITC, design and evolution of the US DF and its interactions with the French and UK Data Facilities and the Chilean and other DACs.
3.2b.2	US DF Technical Lead - SLAC	Responsible for leading the Data, Compute and IT Security team involved in providing foundational services for file-based data, data resident in database engines, and facility-wide services including AAA and operational network security infrastructure.
3.2b.2	US DF Technical Lead - SLAC	Responsible for leading the Data, Compute and IT Security team involved in providing foundational services for file-based data, data resident in database engines, and facility-wide services including AAA and operational network security infrastructure.
3.2b.1	US DF Technical Lead - NOIRLab	Responsible for leading the Data, Compute and IT Security team involved in providing foundational services for file-based data, data resident in database engines, and facility-wide services including AAA and operational network security infrastructure.
3.2c	DF/IDACs Technical Coordinator	Coordinate technical needs among the collection of Data Facilities and IDACS. Respond to issues that come up day to day in connections, transfers etc.
3.2d.0	US DF Data Movement Group Leader	Lead US DF Software Developer, coordinating activities of the US DF Movement Group as well as participating in group's technical activity.
3.2d.0	US DF Data Movement Group Leader	Lead US DF Software Developer, coordinating activities of the US DF Movement Group as well as participating in group's technical activity.
3.2d.1	Data Movement Engineer - SLAC	Maintain Rucio system which will be involved in the tracking and moving of data between multiple sites,including hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites. This is in close conjunction with the Storage Engineers in the Data Facilities. Rucio is an open source HEP product which we have adopted on Rubin Observatory.

3.2d.1	Data Movement Engineer - SLAC	Maintain Rucio system which will be involved in the tracking and moving of data between multiple sites,including hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites. This is in close conjunction with the Storage Engineers in the Data Facilities. Rucio is an open source HEP product which we have adopted on Rubin Observatory.
3.2d.2	Data Movement Engineer - Fermilab	Maintain Rucio system which will be involved in the tracking and moving of data between multiple sites,including hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites. This is in close conjunction with the Storage Engineers in the Data Facilities. Rucio is an open source HEP product which we have adopted on Rubin Observatory.
3.2d.2	Data Movement Engineer - Fermilab	Maintain Rucio system which will be involved in the tracking and moving of data between multiple sites,including hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites. This is in close conjunction with the Storage Engineers in the Data Facilities. Rucio is an open source HEP product which we have adopted on Rubin Observatory.
3.2d.3	Data Movement Engineer - SLAC In-kind	Maintain Rucio system which will be involved in the tracking and moving of data between multiple sites,including hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites. This is in close conjunction with the Storage Engineers in the Data Facilities. Rucio is an open source HEP product which we have adopted on Rubin Observatory.
3.2r	US DF Data Engineer	Integrate Rubin time-series databases and data streams with AI-enabled monitoring and decision-support tools

3.2f.1	Database Administrator - NOIRLab	Administers QSERV, reformatted EFD, and other databases at the US Data Facility and Chilean Base Center. Makes sure the databases are backed up, properly interfaced to the authentication infrastructure. Interfaces with the Security Administrator to ensure access by only authorized users (confidentiality, integrity, and availability). Additional database responsibilities for supporting misc workflows and processes within the Data Facilities. The Database Administrator is also responsible for ensuring data transfers to disaster recovery stores are implemented and functioning according to policy. This assumes significant value engineering is realized by collecting miscellaneous databases into enterprise-level database, with potential additional savings by reusing database infrastructure for other database needs elsewhere in the project. Additional .5-1 FTEs otherwise.
3.2j.0	US DF Services Group Leader	Lead US DF Software Developer, coordinating activities of the US DF Services Group as well as participating in group's technical activity.
3.2j.3	US DF Software Developer - SLAC	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.

3.2j.4	US DF Software Developer - Fermilab	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.
3.2f.2	Database Administrator - SLAC	Administers QSERV, reformatted EFD, and other databases at the US Data Facility and Chilean Base Center. Makes sure the databases are backed up, properly interfaced to the authentication infrastructure. Interfaces with the Security Administrator to ensure access by only authorized users (confidentiality, integrity, and availability). Additional database responsibilities for supporting misc workflows and processes within the Data Facilities. The Database Administrator is also responsible for ensuring data transfers to disaster recovery stores are implemented and functioning according to policy. This assumes significant value engineering is realized by collecting miscellaneous databases into enterprise-level database, with potential additional savings by reusing database infrastructure for other database needs elsewhere in the project. Additional .5-1 FTEs otherwise.

3.2j.5	US DF Software Developer - SLAC/AURA	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.
3.2j.1	Surge US DF Software Developer - SLAC	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.

3.2j.2	US DF Software Developer - AURA/NCSA	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.
3.2j.8	US DF Software Developer - AURA/Enciso	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.

3.2j.6	US DF Software Developer - SLAC In-kind	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets. Provides workload management (eg kubernetes) of the clusters. Other skills to be drawn from python coding, web application development and deployment, continuous integration tooling (eg Jenkins), database expertise, code and I/O optimization. Some of the work involves maintaining and improving the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). This part of the role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.
3.2j.7	US DF Software Developer - Burwood In-kind	USDF Services Group contractor
3.2q	US DF Support Engineer - SLAC	General and broad computing skills, responding to the myriad of issues/needs that will come up - including via user support tickets.
3.2s	US DF Science Platform Support Engineer	Integrate on-premises RSP with GPU model training and analysis workflows
3.2k	Workflow/Load Management Engineer	Maintain smooth operation and configuration of workflow/workload tools for pipeline operation.
3.2k	Workflow/Load Management Engineer	Maintain smooth operation and configuration of workflow/workload tools for pipeline operation.
3.2h	US DF Infrastructure Group Leader	Lead US DF Software Developer, coordinating activities of the US DF Infrastructure Group as well as participating in group's technical activity.
3.2h.1	US DF Infrastructure Group Leader - SLAC In-kind	Lead US DF Software Developer, coordinating activities of the US DF Infrastructure Group as well as participating in group's technical activity.

3.2i	US DF Network & Core Services Engineer - SLAC	Provides network hardware and operational functionality used from a site's border router to Rubin Observatory end equipment. Collaborates with the security engineer and also IT services related to dynamic reallocation of US DF enclaves to support these functions with network features. Supplies higher-level network services as needed at each site, such as DNS, NTP, domain name registrations, netflows, and support for security. Provides Rubin S3DF enclave core services, including login services, name services, and environment maintenance.
3.2i.1	US DF Network & Core Services Engineer - SLAC In-kind	Provides network hardware and operational functionality used from a site's border router to Rubin Observatory end equipment. Collaborates with the security engineer and also IT services related to dynamic reallocation of US DF enclaves to support these functions with network features. Supplies higher-level network services as needed at each site, such as DNS, NTP, domain name registrations, netflows, and support for security. Provides Rubin S3DF enclave core services, including login services, name services, and environment maintenance.
3.2m.2	US DF Network & Core Services Engineer - NOIRLab	Provides network hardware and operational functionality used from a site's border router to Rubin Observatory end equipment. Collaborates with the security engineer and also IT services related to dynamic reallocation of US DF enclaves to support these functions with network features. Supplies higher-level network services as needed at each site, such as DNS, NTP, domain name registrations, netflows, and support for security. Provides Rubin S3DF enclave core services, including login services, name services, and environment maintenance.
3.2n	US DF Technician	Provides technical support for the Rubin US DF hardware at SLAC. Responsible for physical installation tasks: server racking, cabling and power. Lifecycle tasks include maintenance, troubleshooting and repair. Responsibilities may extend to monitoring and updating firmware.

3.2o	Wide Area Network Technical Manager	Responsible for providing coordination amongst and managing relationships with the four independent WAN operators. Acts as the interface for services provided to the US DF in the context of the WAN. Responsible for managing the risk associated with each WAN operator, including developing mitigation strategies and proposed project responses to credible risks. Leads the Joint Wide Area Network Working Group. Well connected to DOE ESNet.
3.2p	Wide Area Network Architect	Familiar with WAN implementation technologies generally available in the networks supporting the Rubin Observatory. Familiar with technology roadmap of the ESNet WAN provider. Synthesizes and evolves network techniques and provisioning supporting the Rubin Observatory mission, as network technology evolves. Drawn from staff of WAN groups but explicitly supported by and work in the context of the Rubin Observatory.
3.2e.3	Data Wrangler - IN2P3	The data wrangler ensures that data (science raw data, calibration data, data products, etc.) is replicated at IN2P3 and data products resulting from the local processing performed at IN2P3 are replicated to the USDF They also ensure that the data archived at IN2P3 and needed for the annual processing are recalled from tape on time for the image processing tasks to be performed. They ensure that the tools and systems used for replicating data at IN2P3 are operational. This role needs tight coordination with the team at the USDF that is responsible for data distribution.
3.2l.3	Image Handler - IN2P3	The image handler ensures the image processing stages assigned to IN2P3 are performed on time. This person also ensures that the processing (e.g. software releases, configuration files, etc.) is compatible with what is agreed upon with the other processing sites, in particular with the USDF. They also ensure that IN2P3's image processing infrastructure (batch processing, workflow management system, etc.) is operational and correctly configured for LSST needs. They also ensure the day-to-day operations of the annual image processing campaign. This role needs tight coordination with the team in charge of image processing at the USDF.

3.2g.3	Catalog Manager - IN2P3	The catalog manager ensures the day-to-day operations of the astronomical catalog database at IN2P3. This includes ingesting new data and removing and archiving obsolete catalogs. They also interact with the data wrangler to ensure that the catalog data produced at other sites are imported and ingested into the IN2P3 catalog and that the catalog data produced at IN2P3 is ingested into the local catalog and replicated to other sites. They also ensure that the software releases for the catalog database are compatible with those releases used at other sites operating a catalog database, in particular, the USDF.
3.2e.4	Data Wrangler - UK	The UK data wrangler ensures that data (science raw data, calibration data, data products, etc.) is replicated and data products resulting from the local processing performed in the UK are replicated to the USDF They also ensure that the data archived in the UK and needed for the annual processing are recalled from tape on time for the image processing tasks to be performed. They ensure that the tools and systems used for replicating data in the UK are operational. This role needs tight coordination with the team at the USDF that is responsible for data distribution.
3.2l.4	Image Handler - UK	The image handler ensures the image processing stages assigned to the UK are performed on time. This person also ensures that the processing (e.g. software releases, configuration files, etc.) is compatible with what is agreed upon with the other processing sites, in particular with the USDF. They also ensure that the UK's image processing infrastructure (batch processing, workflow management system, etc.) is operational and correctly configured for LSST needs. They also ensure the day-to-day operations of the annual image processing campaign. This role needs tight coordination with the team in charge of image processing at the USDF.

3.2g.4	Catalog Manager - UK	The catalog manager ensures the day-to-day operations of the astronomical catalog database at IN2P3. This includes ingesting new data and removing and archiving obsolete catalogs. They also interact with the data wrangler to ensure that the catalog data produced at other sites are imported and ingested into the IN2P3 catalog and that the catalog data produced at IN2P3 is ingested into the local catalog and replicated to other sites. They also ensure that the software releases for the catalog database are compatible with those releases used at other sites operating a catalog database, in particular, the USDF.

Table 14: FRDF roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.2e.3	Data Wrangler - IN2P3	The data wrangler ensures that data (science raw data, calibration data, data products, etc.) is replicated at IN2P3 and data products resulting from the local processing performed at IN2P3 are replicated to the USDF They also ensure that the data archived at IN2P3 and needed for the annual processing are recalled from tape on time for the image processing tasks to be performed. They ensure that the tools and systems used for replicating data at IN2P3 are operational. This role needs tight coordination with the team at the USDF that is responsible for data distribution.
3.2l.3	Image Handler - IN2P3	The image handler ensures the image processing stages assigned to IN2P3 are performed on time. This person also ensures that the processing (e.g. software releases, configuration files, etc.) is compatible with what is agreed upon with the other processing sites, in particular with the USDF. They also ensure that IN2P3's image processing infrastructure (batch processing, workflow management system, etc.) is operational and correctly configured for LSST needs. They also ensure the day-to-day operations of the annual image processing campaign. This role needs tight coordination with the team in charge of image processing at the USDF.

3.2g.3	Catalog Manager - IN2P3	The catalog manager ensures the day-to-day operations of the astronomical catalog database at IN2P3. This includes ingesting new data and removing and archiving obsolete catalogs. They also interact with the data wrangler to ensure that the catalog data produced at other sites are imported and ingested into the IN2P3 catalog and that the catalog data produced at IN2P3 is ingested into the local catalog and replicated to other sites. They also ensure that the software releases for the catalog database are compatible with those releases used at other sites operating a catalog database, in particular, the USDF.

Table 15: UK roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.2e.4	Data Wrangler - UK	The UK data wrangler ensures that data (science raw data, calibration data, data products, etc.) is replicated and data products resulting from the local processing performed in the UK are replicated to the USDF They also ensure that the data archived in the UK and needed for the annual processing are recalled from tape on time for the image processing tasks to be performed. They ensure that the tools and systems used for replicating data in the UK are operational. This role needs tight coordination with the team at the USDF that is responsible for data distribution.
3.2l.4	Image Handler - UK	The image handler ensures the image processing stages assigned to the UK are performed on time. This person also ensures that the processing (e.g. software releases, configuration files, etc.) is compatible with what is agreed upon with the other processing sites, in particular with the USDF. They also ensure that the UK's image processing infrastructure (batch processing, workflow management system, etc.) is operational and correctly configured for LSST needs. They also ensure the day-to-day operations of the annual image processing campaign. This role needs tight coordination with the team in charge of image processing at the USDF.

3.2g.4	Catalog Manager - UK	The catalog manager ensures the day-to-day operations of the astronomical catalog database at IN2P3. This includes ingesting new data and removing and archiving obsolete catalogs. They also interact with the data wrangler to ensure that the catalog data produced at other sites are imported and ingested into the IN2P3 catalog and that the catalog data produced at IN2P3 is ingested into the local catalog and replicated to other sites. They also ensure that the software releases for the catalog database are compatible with those releases used at other sites operating a catalog database, in particular, the USDF.

6.6 DM support in Operations

DM is not responsible for critical systems and hence would work *normal hours* which nominally would be 09:00 to 17:00 Pacific. One may consider *normal hours* in operations may be different and the DM Chile DevOps team will work Chile hours and provide early nighttime support.

We do have DM people in various timezones which may give more coverage however the range of functionality is vast and not everyone can support all of it.

6.7 On-Call Support for Prompt Processing

DM is required to deliver 98% of detectable alerts within the required latency. Loss of a single night represents a sizable portion of this budget, so on-call support of Alert Production and Prompt Processing will necessary throughout operations. LSR-REQ-0025

DM will use a multi-tier triage and on-call system to meet this requirement. Automated metrics systems will raise alarms when images are taken and alerts are not being sent. These will be initially handled by a triage worker on-shift; ideally this work can be split between the US West Coast and/or Europe to minimize shift work after midnight local time. We will develop a playbook to enable the triage to resolve some issues themselves, but it may be necessary for them to page other DM staff members in an on-call rotation to debug more serious problems. Experience suggests that in steady state operations most sustained problems will be due to failures of services, databases, and networks rather than the algorithmic pipeline components.

The Observing Specialists at the summit should also be involved: in particular, in case of a failure of the Long-Haul Networks, images may be taken at the summit

but no alerts produced. We will implement a status display at the Summit that will indicate if alerts are not being sent for the images being recorded. In case of sustained outages the observers may backstop the automated alerts by contacting the triage and on-call staff through appropriate channels.

Members of the triage and on-call team will be drawn from throughout DM, and will include expertise from the Data Facility, Campaign Management, Data Abstraction, and Algorithms & Pipelines. The current Campaign Management pilot for Alert Production will be responsible for maintaining and overseeing the on-call rotation.

Where possible we will use tooling to reduce the risk of downtime, for example by running an automated integration test prior to the start of observing to identify potential new failures due to changes in the deployed pipelines and services. Problems identified can then be fixed during regular working hours.

6.7.1 Out of hours - best effort

DM is committed to supporting the software we developed. Most DM software, apart from Prompt Processing, is not particularly time sensitive.

There are other products build by DM such as the EFD which are critical for which an arrangement needs to be made with TSSW since it is a summit system. There is a discussion of this and other summit items in RTN-069.

Several of us are available out of hours and look at problems when they arise however there is no guaranteed support out of hours.

If we do on call on best effort basis we should agree on some ground rules. Institutionally it may be difficult to formalize these . These might be:

- Should an individual get called out of hours they would not need to be in any meetings or workplace the following morning.
- Any hour worked out of hours may be taken as 1.5 hours leave at another point in time.
- If requested specific mobile phones for on call should be provided (may be hard given our distributed nature).

7 Products

Product	Manager	Owner	Notes
DM Ops	William O'Mullane	Leanne Guy	Data Management (Ops)

Data Abstraction	Tim Jenness		Data Abstraction
Build Engineering	Tim Jenness		Build Engineering
Data Eng	Gregory Dubois Felsmann		Data Engineering
Felis	TBD		Felis
Metadata	TBD		Metadata
Pipe Middleware	Tim Jenness		Pipelline Middleware
Sis Exec	TBD		Single-site Exec
OCPS	KT Lim ?		Observatory Controlled Processing System
Prompt f/ w	TBD		Prompt forwarder
APDB	Andy Salnikov		Alert Production
MPC Sandbox	TBD		Alert Production
PP Next Visit	Hsin-Fang Chiang Krzysztof Findeisen Dan Speck	Ian Sullivan	Alert Production
Alert Arc	Brianna Smart	Brianna Smart	Alert Production
Broker	Brianna Smart	Eric Bellm	Alert Production
MPC Replication	TBD		Alert Production
mpsky	Jake Andrew Kurlander		Alert Production
Butler Writer	Steve Pietrowicz	Tim Jenness	Alert Production
Catch Up		Ian Sullivan	Alert Production
PPDB Replication	Jeremy McCormick	Ian Sullivan	Alert Production
Sattle	Brianna Smart	Brianna Smart	Alert Production
s3daemon	TBD		s3 object transfer daemon
BPS	TBD		BPS
Butler	Tim Jenness	Y (JIm B)	Butler
Control Interface	TBD		Control Interface
ctrl_bps	TBD		ctrl_bps
ctrl_mpexec	TBD		ctrl_mpexec
user batch envelope	TBD		user batch envelope
Pipeline interfaces	TBD		Pipeline interfaces
pex_config	TBD		pex_config
pipe_base	TBD		pipe_base
EUPS	TBD		EUPS and EUPS.lsst.code
Chile & LHN	Cristián Silva		Chile Facilities and Long Haul Networks
Chile DevOps	Cristian Silva		Chile DevOps
LHN	Julio Costanza	Cristián Silva	Long Haul Network
Data Facilities	Adam Bolton		Data Facilities
Data Curation	Wei Yang		Data Curation
Data Backbone	TBD		Data Backbone
Backups	TBD		Backups
Bulk Download	TBD		Bulk Download
Consolidated DB	TBD		Consolidated DB
Butler repos	TBD		Butler repos
Rucio	TBD		Rucio
Butler Main		Aditya Tanikanti	Data Curation
Butler Other		Aditya Tanikanti	Data Curation
DP0.3 Postgres		Fritz Mueller	Data Curation

Embargo		Aditya Tanikanti	Data Curation
HATS	Neven Caplar	Neven Caplar	Data Curation
LFA Replication		Aditya Tanikanti	Data Curation
Prompt Pub	David Irving	Wei Yang	Data Curation
S3 Notifications	TBD		Data Curation
Unembargo		Wei Yang	Data Curation
xfer Summit USDF		Aditya Tanikanti	Data Curation
OODS	Steve Pietrowicz		Observstory Operations Data System
FrDF	Fabio Hernandez		French Data Facility
Infrastructures	TBD		Infrastructures
CDAC	Frossie Economou		Chile Data Access Center
FrDF	Fabio Hernandez		French Data Facility
SDF	Cristián Silva		Summit and Base Data Facility
UKDF	George Beckett		UK Data Facility
USDF	TBD		US Data Facility
trans embargo	TBD		Transfer Embargo
Multi-site & User Exec	TBD		Multi-site & User Exec
PanDA	TBD		PanDA
User Batch	TBD		User Batch
UWS	KT lim		Universal Worker Service
UKDF	Geroge Beckett		UK Data Facility
USDF	Adam Bolton		US Data Facility
Stack maint	TBD		Shared Stack
DM Science	Leanne Guy		DM Science
CST	Mellissa Graham		Community Science Team
Citizen Science	TBD		Citizen Science
DR support	TBD		Data Release Support
Forum	TBD		Forum traccking/ supor
Internal	TBD		Inward facing testingt/ support
NB support	TBD		Notebok Support
Data Production	Colin Slator		Data Production
Campaign Management	Yusra AlSayyad	Y (N/ A)	Campaign Management
BPS	Michelle Gower		Data Release Production
CM Service	Toby Jennings	Colin Slater	Data Release Production
HTCondor	Greg Daues	Yee-Ting Li	Data Release Production
Transfer Monitoring	Dan Speck		Monitoring and Telemetry
FTS		Wei Yang	Data Release Production
Obsloctap	William O'Mullane		Monitoring and Telemetry
OpenSearch	Timothy Noble Kenneth Herner	Wei Yang	Data Release Production
PanDA	wen guan Zhaoyu Yang	Torre Wenaus	Data Release Production
Rapid Analysis	Merlin Fisher-Levine	Colin Slater	Data Release Production
Rucio-Butler Int	Steve Pietrowicz	Wei Yang	Data Release Production
Rucio		Wei Yang	Data Release Production
Sasquatch USDF	Angelo Fausti		Monitoring and Telemetry
VOMS		Wei Yang	Data Release Production

Algorithms & Pipelines	Yusra AlSayyad	? (Jim Bosch)	Algorithms & Pipelines:In ops our construction POs (JimB+EricB) become our group leads, so PO prob not necessary.
Calibration	Christopher Waters		Calibrations
DV	Colin Slator		Data Validation
Systematics	TBD		Analyse for release systematics
Science Production	TBD		Guide release production
SDQA	TBD		Science Data Quality Assurnace for Rleases
Nightly Digest	Valerie Becker Sebastian Aranda	Valerie Becker	QA
Sched Pre-Night	Lynne Jones Eric Neilsen Peter Yoachim	Eric Neilsen	QA
ConsDB Tap	Jeremy McCormick		QA
ConsDB	Brian Brondel Rodrigo Boufleur Jeremy McCormick		QA
Exposure Checker	Alex Drlica-Wagner Colin Slater	Colin Slater	QA
fov-quicklook		Gregory Dubois-Felsmann	QA
MAF	Lynne Jones Eric Neilsen Peter Yoachim	Lynne Jones	QA
Night Logs	Sebastian Aranda	Sebastian Aranda	QA
Plot Navigator	Colin Slater	Colin Slater	QA
RubinTV	Guy Whittaker	Merlin Fisher-Levine	QA
Schedview Snapshots	Eric Neilsen Lynne Jones Peter Yoachim	Eric Neilsen	QA
Scheduler Pages	Eric Neilsen Lynne Jones Peter Yoachim	Eric Neilsen	QA
Summit DB Repl	Sebastian Aranda		QA
Data Services	Frossie Economou		Data Services
Complex. DB	Fritz Mueller	Y (Colin)	Complex Database Support:Should this be complex Databases or somethign ? Qserv under
Big Databases	Fritz Mueller		Big Databases
PromptDV	TBD		Prompt Products DB
Qserv	Fritz Mueller		Qserv
User Databases	TBD		User Databases
Octavius	TBD		Rubin Science Platform
SQuaRE	Frossie Economou		SQuaRE
Doc Services	TBD		Doc Services
Documentation standards	TBD		Documentation standards
LtD	TBD		LtD

Templating	TBD		Templating
Phalanx	TBD		Phalanx
Authorisation	TBD		Authorisation
Reliability Engineering	TBD		Reliability Engineering
Secrets	TBD		Secrets
Planned Obs.	Willam O'Mullane		Planned Observation Publication
RSP	Frossie Economou	Leanne Guy	Rubin Science Platform
APIs		Y (GPDF)	APIs:IVOA and non-VO Apis
data.lsst.cloud	TBD		data.lsst.cloud
Authentication			Authentication:and security engineering
Notebook		Y (KSK)	Notebook
Portal		Y (GPDF)	RSP Portal
Square One	TBD		Square One
User Support			User Support:clo service and helpdesk
Sasquatch	TBD		Sasquatch
EFD	TBD		EFD
Metrics	TBD		Metrics
Telemetry Gateway	TBD		Telemetry Gateway
QServ	Igor Gaponenko John Gates Fritz Mueller	Colin Slater	Rubin Science Platform
RSP	TBD		Rubin Science Platform
S3Proxy	TBD		Rubin Science Platform

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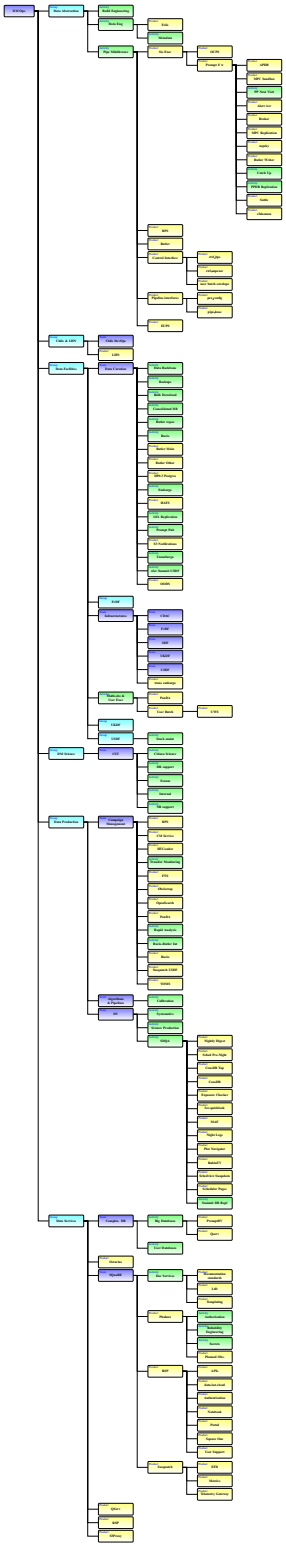

FIGURE 4: DM operations product tree

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B Acronyms

Acronym	Description
AD	Associate Director
APDB	Alert Production DataBase
Adam	Adaptive Moment Estimation
B	Byte (8 bit)
BPS	Batch Production Service
CDF	Cumulative Distribution Function
CM	Configuration Management
CST	Community Science Team
DAC	Data Access Center
DAQ	Data Acquisition System
DB	DataBase
DF	Data Facility
DM	Data Management
DMS	Data Management Subsystem
DMTN	DM Technical Note
DP	Data Production
DP0	Data Preview 0

DR	Data Release
DRP	Data Release Processing
DWDM	Dense Wave Division Multiplex
EFD	Engineering and Facility Database
EUPS	Extended Unix Product System
FITS	Flexible Image Transport System
FRDF	French Data Facility
FTE	Full-Time Equivalent
FTS	File Transfer Service
FrDF	French Data Facility
IT	Information Technology
ITTN	IT Technote
IVOA	International Virtual Observatory Alliance
LDM	LSST Data Management (Document Handle)
LFA	Large File Annex
LHN	long haul network
LSE	LSST Systems Engineering (Document Handle)
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
MAF	Metric Analysis Framework
MPC	Minor Planet Center
NCSA	National Center for Supercomputing Applications
NOIRLab	NSF's National Optical-Infrared Astronomy Research Laboratory; `https://noirlab.edu`
OCPS	OCS Controlled Pipeline System
OODS	Observatory Operations Data Service
PO	Program Operations
PPDB	Prompt Products DataBase
PanDA	Production ANd Distributed Analysis system
QA	Quality Assurance
RDM	Rubin Data Management
RDO	Rubin Directors Office
RSP	Rubin Science Platform
RTN	Rubin Technical Note

S3	(Amazon) Simple Storage Service
SDQA	Science Data Quality Assessment
SLAC	SLAC National Accelerator Laboratory
SQuaRE	Science Quality and Reliability Engineering
TBD	To Be Defined (Determined)
UK	United Kingdom
UKDF	United Kingdom Data Facility
US	United States
USA	United States of America
USDAC	United States Data Access Center
USDF	United States Data Facility
UW	University of Washington
UWS	Universal Worker Service (IVOA standard)
VO	Virtual Observatory
VOMS	VO Management Service
VRO	(not to be used)Vera C. Rubin Observatory
WBS	Work Breakdown Structure
bps	bit(s) per second