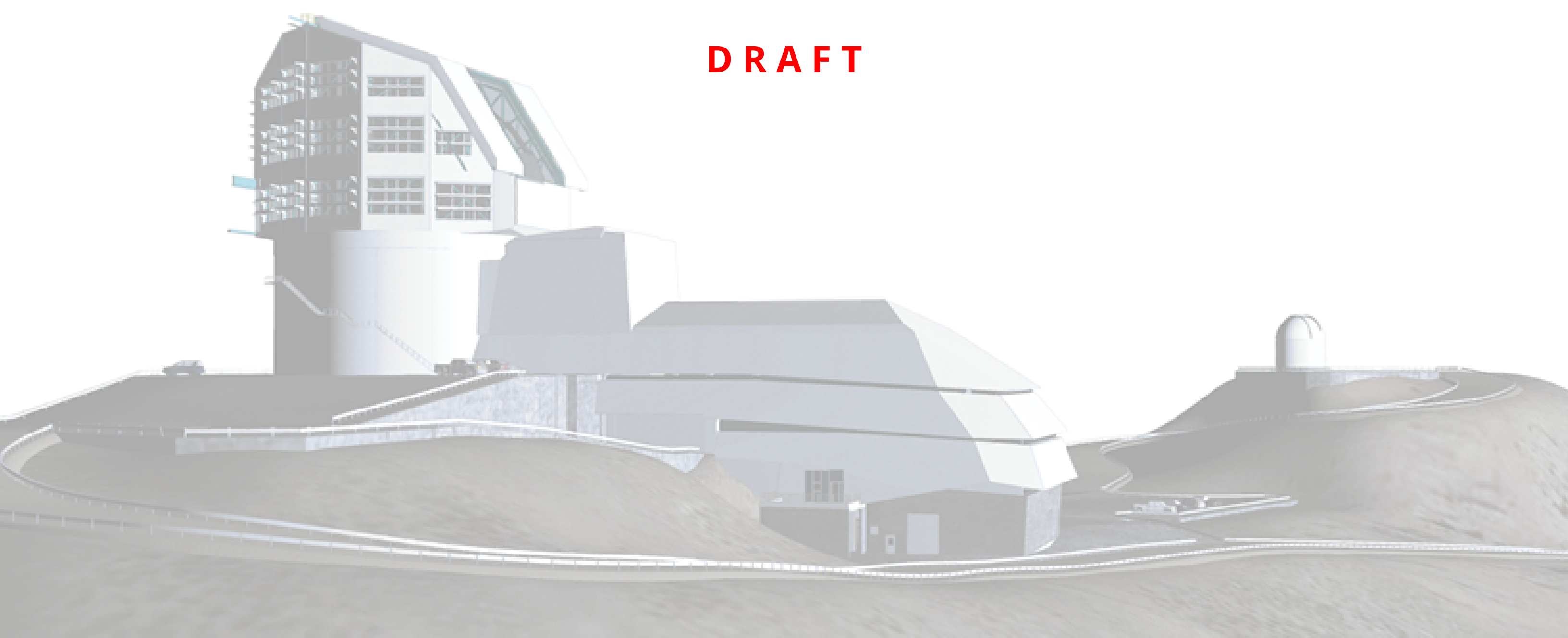
Vera C. Rubin Observatory
Data Management

Rubin Observatory Risk and Opportunity Management Plan

Austin Roberts, Robert Blum, Chuck Claver, Leanne Guy, Phil Marshall, Wil O'Mullane, Kevin Siruno, Matthew Rumore.

RDO-71

Latest Revision: 2023-02-17



Abstract

The document provides the Rubin Observatory Risk and Opportunity Management Plan.

Change Record

Version	Date	Description	Owner name
1	2022-12-12	Unreleased.	Matthew Rumore

Document curator: TBD

Document source location: `https://github.com/lsst/RDO-71`

Contents

Rubin Observatory Risk and Opportunity Management Plan

1 Introduction and Background

This document describes the Risk & Opportunity Management Plan used to primarily identify, assess, respond to, and manage risks and opportunities associated with the technical, cost and schedule aspects for the Vera C. Rubin Observatory throughout operations and Legacy Survey of Space and Time (LSST) survey. The Rubin Observatory Risk & Opportunity Management Plan recognizes the benefits of managing uncertainty during operations in a holistic and systematic manner.The Risk & Opportunity Management Plan is one plan in a group of Rubin Observatory Operations plans that collectively define a comprehensive approach to managing risk, and opportunity, which are collectively known as approaches to making decisions under conditions of uncertainty.

Risk of harm to personnel and equipment is the focus of the Rubin Observatory Safety Policy (RDO-015). Further aspects of risk and safety management are codified under the NSF (National Science Foundation) NOIRLab (formally named the National Optical Infrared Astronomy Research Laboratory) and the Department of Energy (DOE) SLAC Laboratory (SLAC National Accelerator Laboratory) documents where appropriate. Where appropriate, risk, safety, and hazard analysis plans are adopted wholly for Rubin Observatory Operations from the Rubin Observatory Construction Project (which is not a part of OIR Lab).

The key aspects of the Risk & Opporutinty Management Plan are:

- A standard methodology to identify and assess major risks and opportunities associated with Operations work breakdown structure (WBS) elements and operations functions from the Operations Plan.
- A continuous process to review and re-assess current risks and opportunities on a quarterly or semi-annual basis and address new risks and opportunities as they emerge.
- Common techniques for assignment of budget and schedule for the anticipated response in the event of a realized risk.
- An approach and tool to measure and compare to contingency levels, the remaining major risk exposure across operation.

- A single dynamic and interactive system to inform management, to support communication across operations, to facilitate and encourage regular participation of team members, and to produce standard reporting and tracking features.

1.1 Risk Management Process Overview

The risk management process is a continuous and proactive approach to keeping risk at an acceptable level through awareness, tracking, and response handling. The Rubin Observatory Risk Management process is an event-centric approach. It is characterized by the identification of events that may occur in the future with resulting negative or positive consequences for operations. There are different types of risk associated with Rubin Observatory Operations:

- Technical Risk, consisting of the risk of not meeting survey performance requirements or deliverables;
- Cost Risk, consisting of the risk that the available budget will be insufficient to cover the scope of operations;
- Schedule Risk, consisting of the risk that the survey will fail to meet scheduled milestones; and,
- a related category of risk is called Programmatic Risk, which is risk produced by events that are beyond the control of the operations management team, where programmatic Risk can be a source of risk in any of the other three risk categories.

In transitioning from the construction phase to operations, the operations team will consult with the Rubin Observatory project to understand any project risks that might transfer to operations or (more likely) evolve into operations risks. During the pre-operations phase, which occurs in parallel with the project integration and commissioning phases, the operations team will work closely with the project team to understand all risks, safety plans, and hazards and adapt, revise, and establish analogous processes, procedures, and policies. This transition will take place from the beginning of pre-operations and be completed no later than the Operations Readiness Review (ORR), which marks formal handover of the Rubin Observatory system from the project to the operations team.

1.2 Risk Management Tools

The Rubin Observatory Operations team expects to maintain several Risk Management Tools that collectively provide a comprehensive means of managing overall operations uncertainty exposure and communicating this information to stakeholders. Each of these tools is described in detail in the following section.

The model for managing risks and opportunities follows the NOIRLab model, see Figure 1. The project will use the Alcea Tracking Solutions (ATS) software tool, which is used and managed by NOIRLab for risk management of all its major projects. Risks are reported to AURA and SLAC management, as well as NSF through NOIRLab quarterly reports. The user guide for this tool is located on .

Rubin Observatory Operations may adopt the current Jira-based tool to track risk in operations.

1.3 Roles and Responsibilities

The Rubin Observatory Risk & Opportunity Board (RROB) serves as the managing group for the Risk & Opportunity Management Plan. The RROB is managed by the System Performance (SP) Department.

The **Rubin Observatory Operations Director** has overall responsibility for managing and controlling operations risks. The Director will work with the senior managers to review and assess current risks on a quarterly basis. The Director will also approve all new risks (or delegate this responsibility as appropriate to another operations manager) in coordination with the RROB.

The **Rubin Observatory Executive Council** is the group of operations management and leadership staff charged with reviewing the risk registry, evaluating the risk and opportunity assessments, collaborating on risk handling options, and developing implementation recommendations, which are forwarded to the Director of operations. The Executive Council consists of the Associate Directors (ADs) and Deputy Directors as well as other operations staff. It is expected that the head of safety for NOIRLab will meet with the Executive Council to regularly review risks.

FIGURE 1: NOIRLab Risk Management Model.

1.4 Risk & Opportunity Definitions

Risk (also known as **Threat**) — XXX. Note that the term ”risks” is used throughout this document as a negative impact, also known as a ”threat” in the NOIRLab risk model where the term ”risk” is used for positive (an ”opportunity”) and negative impacts. The degree of exposure to an event that might happen to the *detriment* of a program, project or other activity. It is described by a combination of the probability that the risk event will occur and the consequence of the extent of loss from the occurrence, or impact. Risk is an inherent part of all activities, whether the activity is simple and small, or large and complex. Risks are categorized into four types depending on how they impact operations — technical, budget (cost), schedule and programmatic.

Issue — A risk that has been realized, e.g. the undesired outcome has materialized.

Technical Risk — The possibility that a technical requirement of the system may not be achieved in the system life cycle. Technical risk exists if the system may fail to achieve performance requirements; to meet operability, producibility, testability, or integration requirements; or to meet environmental protection requirements. A potential failure to meet any requirement that can be expressed in technical terms is a source of technical risk (INCOSE, pg. 220).

Budget (Cost) Risk — The possibility that available budget for operations will be reduced or insufficient to cover operations activity. Cost risk exists if: a) Rubin Observatory must devote more resources than planned to achieve technical requirements; b) Rubin Observatory must add resources to support slipped schedules due to any reason; c) if changes must be made to the scope of operations; or d) if changes occur in the organization (i.e., Rubin Observatory, Association of Universities for Research in Astronomy [AURA] and/or NOIRLab, SLAC) or national economy. Budget risk can be predicted at the total operations level or for a system element or activity. The collective effects of activity or element-level cost risk can produce cost risk for Rubin Observatory generally (INCOSE, pg. 220).

Schedule Risk — The possibility that Rubin Observatory will fail to meet scheduled milestones. Schedule risk exists if there is inadequate allowance for delays in survey execution. Schedule risk exists if difficulty is experienced in achieving schedule accomplishments, such as the timely accumulation of survey data or data release. Schedule risk can be incurred at the total operations level for milestones such as deployment of the first data release. The cascading effects of activity or element-level schedule risks can produce schedule risk for Rubin Observatory generally (INCOSE, pg. 220).

Programmatic Risk — Produced by events that are beyond the control of the Rubin Observatory management team. These events often are produced by decisions made by personnel at higher levels of authority, such as reductions in Rubin Observatory priority, delays in receiving authorization to proceed with a change to the operations plan, reduced or delayed funding, changes in organization or national objectives, etc. Programmatic risk can be a source of risk in any of the other three risk categories (INCOSE, pg. 220). AURA holds an independent risk register for Rubin Observatory Operations.

Risk Management — The art and science of planning, assessing, and handling future events to avoid unfavorable impacts on Rubin Observatory budget, schedule, or performance to the extent possible. Risk management is a structured, formal, and disciplined activity focused on the necessary steps and planning actions to determine and control risks to an acceptable level. Risk Management is an event-based management approach to managing uncertainty.

Risk and Opportunity Responses — Responses are strategic process(es) controlling identified risks, whereby the stakeholders decide how to deal with each risk be it opportunities or threats.

Risk and Opportunity Actions — Actions taken to implement a response plan if a threat or opportunity is realized.

Described below are the four basic response types to risks (threats).

Avoidance — Avoid the risk through the change of requirements or redesign (INCOSE, pg. 223).

Mitigation (also known as **Control**) — Requires the expenditure of budget or other resources to reduce the likelihood and/or consequence. Mitigations are proposed activities that are not part of the operations baseline. Once mitigation activities are approved, they are just baselined activities and no longer referred to as mitigations.

Transfer — Transferring responsibility for the risk by agreement with another party that it is in their scope to mitigate and respond to impacts if the risk is realized. Purchasing insurance is an example of transferring risk.

Acceptance — Accept the risk and the consequences of it becoming realized.

Opportunity (also known as **Benefit** — The degree of exposure to an event that might happen to the benefit of a program, project, or other activity. It is described by a combination of the probability that the opportunity event will occur and the consequence of the extent of gain from the occurrence, or impact. There are two levels of opportunities. At the macro level, a project itself is the manifestation of the pursuit of an opportunity. At the element level, tactical opportunities exist, whereby certain events, if realized, provide a cost or schedule savings to the project or increase survey performance.

Opportunity Management — The proactive art and science of planning, assessing, and handling future events to seek favorable impacts on project, cost, schedule, or performance to the extent possible. Opportunity management is a structured, formal, and disciplined activity focused on the necessary steps and planning actions to determine and exploit opportunities to the extent possible.

Described below are the four basic response types to opportunities.

Exploit — Increase the likelihood of the opportunity occurring through the expenditure of budget or other resources. The expenditure of budget should be evaluated against the probability weighted exposure of the opportunity to ensure that the likely net payoff is a positive one.

Share — Distributing the risk across multiple stakeholders (teams/projects/programs).

Enhance — An action that is taken to increase the chance of the opportunity occurring.

Ignore (also known as **Acceptance**) — Accept the opportunity as stated and do nothing about it for the time being.

Contingency — Rubin Observatory Operations has no formal "cash" contingency. Contingency can be gained by reducing scoped activities or deliverables in the operations plan.

Contingency Management — The formal process that provides the project the ability and flexibility to solve unforeseen issues that may impact the project's budget, schedule, and technical performance. The process incorporates activity-based uncertainties and high impact event-based uncertainties. This is fundamentally the annual and multiyear planning cycle for operations. It is expected such replanning could happen on timescales of less than one year for dramatic events (unexpected reduced funding from the NSF and/or DOE). Regular annual planning cycles may result in modest changes to scope and deliverables based on annual appropriations, and Rubin Operations will work with the agencies to plan on multiyear timescales.

Event — A specific incident/item that occurs at unique points in time (specific time, distributed time period, or random) during operations. Events are defined in terms of something happening and are independent of activities. Events with negative consequences, when coupled with their probability of occurrence, impact to operations, and handling approach, are the basis for defined entries in the Risk Register.

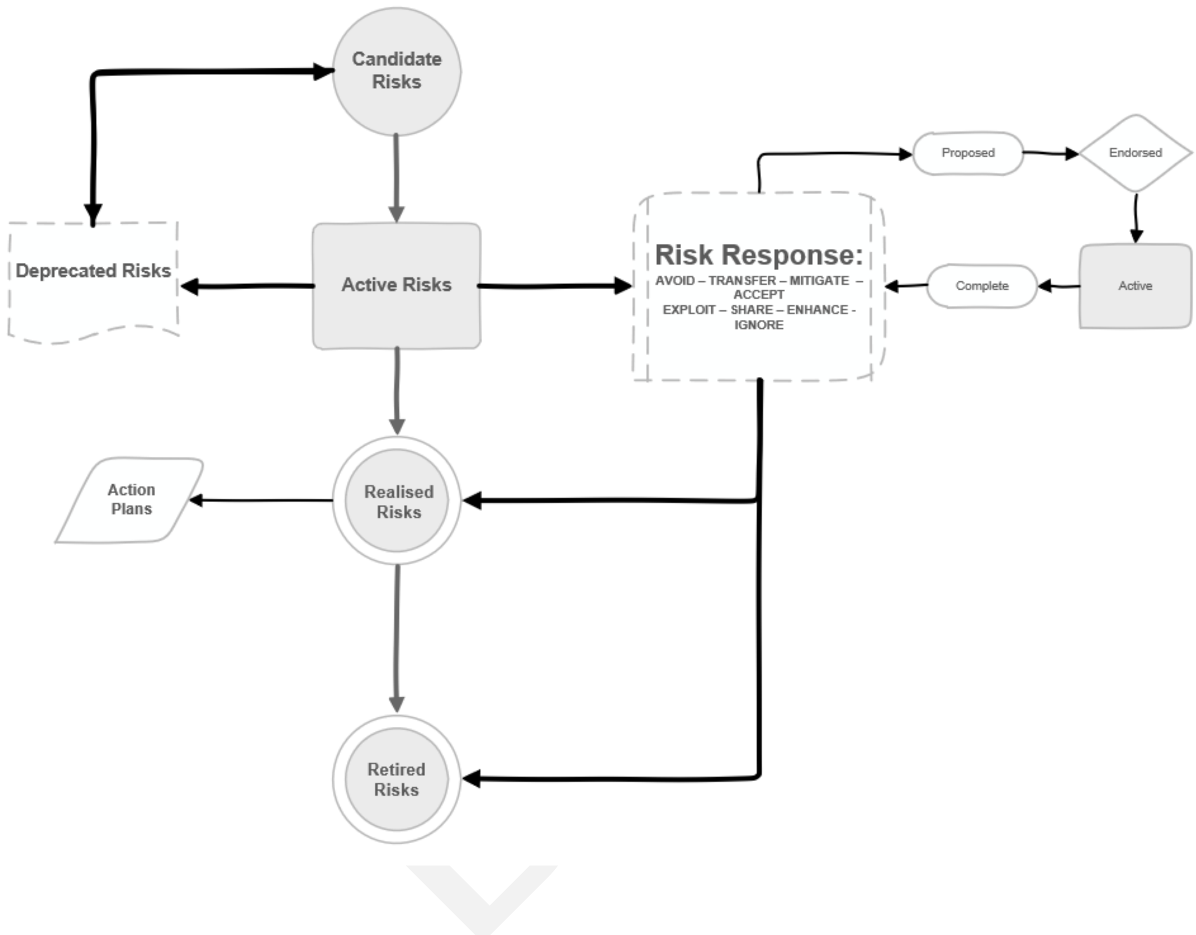
Activity — A specific task or set of tasks that are required by Rubin Observatory Operations, use up resources, and take time to complete (Project Management, pg. 338).

2 Risk & Opportunity Management Process

This section describes the process by which risks and opportunities are managed during observatory operations. Risks and opportunities are set to one of the statuses and follow the lifecycle described in Figure 2.

- **Candidate** — Risks and opportunities in a draft state, which are not actively managed by the project.
- **Active** — Risks and opportunities deemed valid, and actively managed by the project.
- **Realized** — Risks and opportunities which have been realized. There are three models available for the trigger:
  - **Specific Trigger Date** — A specific calendar date when contingency funds must either be obligated to respond to a risk, the risk can be retired, or an opportunity's beneficial event will occur.
  - **Random Occurrence** — Certain risks or opportunities are known to potentially occur but their date(s) are random; for example, critical staff may depart the project, weather delay, equipment failure. This type of event requires an estimate of the number of random occurrences and the cost of each.
  - **Distributed Occurrence** — Identical risks or opportunities are sometimes distributed throughout periods in the project; for example, software packages are evaluated for performance on an annual basis. This type of event distributes the possible contingency obligation profile over the specified time span.
- **Retired** — Risks and opportunities which can no longer valid or actively managed, as they have been realized or the event trigger can no longer occur.

FIGURE 2: Lifecycle of Risks.



- **Depreciate** — Risks and opportunities that were deemed invalid and are were not actively managed.

3 Risk & Opportunity Identification and Assessment

This section describes who and how risks and opportunities are identified and assessed. This is currently written when using the NOIRLab Risk Tool.

1. The managing group creates a risk or opportunity in the ATS Risk Tool as a "Candidate."
2. RROB reviews content, then either asks for more information or sets risk to "Active."

3. After

3.1 Create Risk Item

Minimum content before saving in Risk Tool:

- Project — Rubin Operations
- Risk Type — Threat or Opportunity
- Risk Department — Select Rubin Observatory department which owns the risk and its assessment
- Risk Owner — Point-of-contact for ownership and technical information regarding risk
- Risk Category — Select from list (need to add list to RDO-71)
- Risk Title — Short, descriptive title
- Risk Statement — Description of risk, which must include the IF-THEN statement at a minimum.
- Status — Automatically set as ”Candidate”

Optional fields:

- Risk Sub Category — Select from list (need to add list to RDO-71)
- Parent — Any applicable Parent risks

3.2 RROB Candidate Risk Review

Should be reviewed by POC before submitting. RROB to review for sufficiency and accuracy of information for managing group for ability to manage effectively as an Active risk.

Minimum content before submitting to RROB:

- Cost Impact — According to risk table (need to add risk table to RDO-71)
- Likelihood — According to risk table (need to add risk table to RDO-71)
- Schedule Impact — According to risk table (need to add risk table to RDO-71)
- Cost or Schedule Impact Description, if over certain severity.
- Cost or Schedule fields under Analyze Risk Quantitative, if over certain severity.
- Plan Type, and a minimum of one related Reponse Plan
- Realized Risk Plan — Description of event trigger
- All fields under Analyze Risk Quantitative — note that these do not automatically populate any required fields.
- Existential Risk

Optional fields:

- Overall Impact — Impact category that can override the automatically generated cost and schedule impact categories (sets to most severe)
- Cost or Schedule Impact Description
- Related Actions

Verify assessment in the automatically generated fields under Analyze Risk Score.

3.3 Continuous Review and Updates to Active Risks

TBD for RROB monthly meetings. Managing departments should review risks on a frequency based on severity.

3.4 Realized Risk Trigger

Review of all Response Plans and Actions by POC, and follow-up review with department management. Department management review with RROB (required if over certain severity). Review with DO, RROB and department for any escalation, with any review and discussion with NOIRLab.

3.5 Retiring Risks

Review of close-out due to realized risk, or if event cannot trigger. RROB to review before retiring risk that didn't trigger. All actions should be completed in the Risk Tool (could include Jira tickets for follow-up work) before retiring risk that did trigger. Documentation updates should be considered.

3.6 Risk Assessment

There are six aspects to assessing the state of each risk and opportunity within a subsystem:

1. Identification: identifying elements of risk in the department's activity.
2. Establishing time frame: determining the likely time at which an event would come to pass.
3. Assessing probability: estimating the probability that an undesirable event may occur.
4. Assessing severity: gauging the severity of the impact that such an event would have on the status of the project if the event were to occur.
5. Developing risk options: developing plans to avoid, accept, mitigate, or transfer.
6. Developing a management response: consider how the project may respond if the event should occur.

4 Risk & Opportunity Response Monitoring and Control

This section describes how risks and opportunities responses, monitored and controlled.

4.1 Risk & Opportunity Response

The definition of responses are included in the ATS Risk Software. The following include the definition of response plans to risks, and additional comments are included in .

- **Avoid** — changing your strategy or plans to avoid the risk. This risk response strategy is about removing the threat by any means. That can mean changing your management plan to avoid the risk because it's detrimental to the project/program.
- **Transfer** — passing ownership and/or liability to a third party - Transfer or pass the work on resolving the risk to a third party. For e.g. purchase fire insurance for an unfinished building.
- **Mitigate** — reducing the probability and/or impact of the risk below a threshold of acceptability - Some risks cannot be avoided and need to take action to reduce the impact of the risk. For e.g. work procedures and equipment designed to reduce workplace safety risks.
- **Accept** — recognizing residual risks and devising responses to control and monitor them - This risk response strategy consists of identifying a risk and documenting all the risk management information about it, but not taking any action unless the risk is realized.

The following include the definition of response plans to opportunities.

- **Exploit** — Exploiting a risk to make use of the opportunity that becomes available if that risk occurs.
- **Share** — Distributing the risk across multiple stakeholders (teams/projects/programs)
- **Enhance** — Enhancements is an action that is taken to increase the chance of the opportunity occurring.
- **Ignore** — Opportunities that cannot be actively addressed through exploiting, sharing or enhancing can perhaps be ignored, with no special measures being taken to address them.

A References

B Acronyms

Acronym	Description
AURA	Association of Universities for Research in Astronomy
DM	Data Management
DOE	Department of Energy
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
NOIRLab	NSF's National Optical-Infrared Astronomy Research Laboratory; `https://nationalastro.org`
NSF	National Science Foundation
OIR	optical and infrared astronomy
ORR	Operations Readiness Review
POC	Proof Of Concept
RDO	Rubin Directors Office
RTN	Rubin Technical Note
SLAC	SLAC National Accelerator Laboratory
SP	Story Point
TBD	To Be Defined (Determined)
WBS	Work Breakdown Structure