

Rubin Observatory Operations: Enabling collaborative ground-up budget planning across a multi-team organization

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ABSTRACT

Change is inevitable in large, big-budget operational programs. Embracing, rather than resisting, change is key to being proactive. It also keeps teams motivated as it's another avenue for leadership to "listen" to what is going on at the team level. At Rubin Observatory, an agile approach to budgeting has been implemented, following related experience in previous High Energy Physics experiments. Annually, a ground-up review, to address changing needs, priorities and emerging issues, is carried out across all departments of the Rubin Operations organization. This "annual scrub" provides an opportunity to adapt and be nimble to changing situations that can affect resources and budgets. This paper provides details on the importance of an annual budget scrub, the processes followed, the tools used, and how the cycle continues year on year.

Keywords: Vera C. Rubin Observatory, budget, planning, funding

1. INTRODUCTION

Vera C. Rubin Observatory¹ is currently under construction. Once complete, the observatory will consist of an end to end system with the mountain top Summit Facility on Cerro Pachon in Chile housing an 8.4m telescope and a 3200 megapixel camera, a high bandwidth long haul network, a system of data processing facilities in California, France and the UK, a data management system, a data access platform in the cloud, and a host of public engagement programs. Naturally this means the observatory is distributed across a number of locations.

The observatory is due to start full operations in 2025; the survey will be carried out over a period of ten years, and a post-operations phase will follow. The operation of Rubin Observatory is fairly unique in astronomy for being funded in approximately equal shares by two US government agencies, and operated by two almost equal partner national laboratories (NSF NOIRLab and SLAC National Accelerator Laboratory, funded by the Department of Energy). Budgets are usually set at high level years in advance, but things rarely stay the same.

This paper describes an annual ground-up budgeting process adapted from the one used by the US-ATLAS operations team, in support of the ATLAS experiment at the Large Hadron Collider at CERN.^{2,3} The aim of this annual exercise is to enable change within the budget envelope. The paper provides the reader with details of all the tools that are used, and describes the process that is followed annually.

2. PROCESS

Throughout the Rubin pre-operations and survey operations phases, annually in May each team will look back at what was planned, what was achieved, do a full review of its activities, and propose a high level plan for the following (US fiscal) year.

Such an "annual scrubbing" is standard practice in other high energy physics experiments. The scrub allows the facility to continuously evolve its operating plan, taking critical input from the people that understand best what is really needed. In Rubin's case that is the Team Leaders, who are responsible for delivering products.

Following the U.S. National Science Foundation and U.S. Department of Energy joint annual review of Rubin Operations (typically in April) the Rubin Operations Directors Office together with department heads sets the

major milestones for the next US fiscal year (FY) starting 1st October. This includes looking at the status of major milestones for the current year and ascertaining whether any of those need to carry over into the next FY.

With the major milestones set, the Directors Office kicks off the month long annual scrub process (see Figure 1), in which the department heads start downstream planning with their teams.

This is the “homework” phase of the scrub, where teams are looking at:

- status of minor milestones for the current FY;
- setting minor milestones that would contribute to accomplishing the new major milestones for the next FY;
- planned resources, both labor and non-labor, based on activities needed to achieve the minor milestones, and risk mitigation plans;
- whether there is a mismatch between the resources needed and the resources available; if needed, the team will propose changes during this scrub period through the scrub “sandbox” tool (described in the next section).

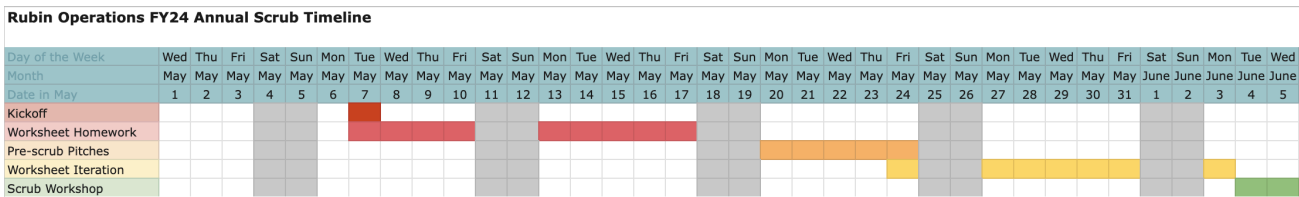


Figure 1. Scrub timeline

Having completed the above homework in the tool provided, the scrub moves into the “pitches” phase. Department Heads and Team Leaders prepare short presentations, for which a structured template is provided, to pitch the proposed changes to the Directors Office. As additional resource requests from one department could impact another, all Department Heads and Team Leaders are invited and encouraged to attend all teams’ pitches, in an observatory-wide 3-day “scrub workshop.” Currently in Rubín the 15-30 minute team level pitches are presented department by department and in fully virtual format. This is in contrast to the US-ATLAS experiment, where the teams come together for an in-person workshop to present their proposals. (The Rubín teams are widely distributed, geographically).

After the pitches phase is complete, a period of iteration takes place between the Directors Office and each Department/Team, in order to reach an agreement on which changes will be implemented and how. Some compromise is needed at this point, due to budgetary constraints – and the Team Leaders understand this, having been briefed at a virtual “kick-off” meeting at the start of the homework phase.

The Directors Office aggregates and costs the baseline vs proposed changes, both labor and non-labor, across the Rubín departments to ensure the program remains overall within the defined financial envelope. This is one of the reasons for the back and forth iterations and negotiations as priorities have to drive this process. The aggregation is performed automatically and in real-time by the sandbox tool, so that Team Leaders and Department Heads can immediately see the impact of the changes being proposed.

After agreement, the changes are implemented (by the Directors Office staff) by propagating them throughout the Rubín planning tools. This culminates in implementation of the new spending plan for the next FY in the accounting systems at SLAC and AURA. Statements of Work for the next year contracts can then be generated (in July) enabling requisitions to be input in time for contracts to be placed.

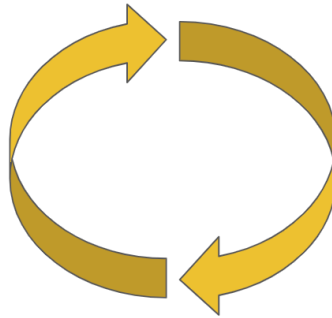
With the resources now updated across all the observatory’s planning tools, the teams can start realistically planning work for the coming FY by defining the tasks and activities that will lead to completion of the defined minor milestones within the boundaries of the available resources. Work then commences at the start of the FY. The work planning is done in the Atlassian tool Jira, where the milestones are defined enabling downstream

and upstream traceability between milestones to tasks. (A full appreciation of Jira is beyond the scope of this paper.)

From the start of the FY, the Directors Office collects inputs such as overhead rates, escalation rates etc., as defined by the managing organizations, and prepares the planning tools for the next annual scrub, and so the cycle continues (see [Figure 2](#)).

October-March: Director's office accumulates top-down input to the following year's schedule and budget and incorporates it into planning tools (e.g. overhead rates, risk updates, schedule impacts, budget impacts etc.)

April: Following annual agency review, Director's office sets major milestones, and issues budget guidance to departments.



May: Departments/Teams set minor milestones, define activities, and scrub budgets, then propose changes to their spending plans.

September: Teams plan work in Jira epics, towards minor milestones. Incorporating community input from annual workshop.

June/July: Director's office finalizes spending plan based on scrub input, completes the Program Operations Plan, uses plan to define Statements of Work for following year contracts.

Figure 2. The annual planning and scrub cycle

3. TOOLS

This section describes the tools used for the scrub process. With the requirement for agility, collaborative working and ease of linking to existing tools, Google Workspace is the chosen platform on which all the Rubin planning tools, including the scrub tool, have been developed. The particular tool that supports the annual scrub is a Google Sheets workbook called the "Scrub Sandbox." It needs to facilitate:

1. capturing the current state of the operations plan for each team;
2. capturing what the desired changes are;
3. inputting flow down milestones for the upcoming FY based on higher level milestones defined by the Directors Office;
4. standardizing inputs coming in from the Departments and Teams;
5. easy visualization of the impact of the desired change on the labor and non-labor budgets;
6. collaboration between Team Leaders as they work through their competing needs.

Furthermore, the tool needs to enable the following aspects of the overall operations plan to be scrubbed:

1. Work Breakdown Structure (WBS);

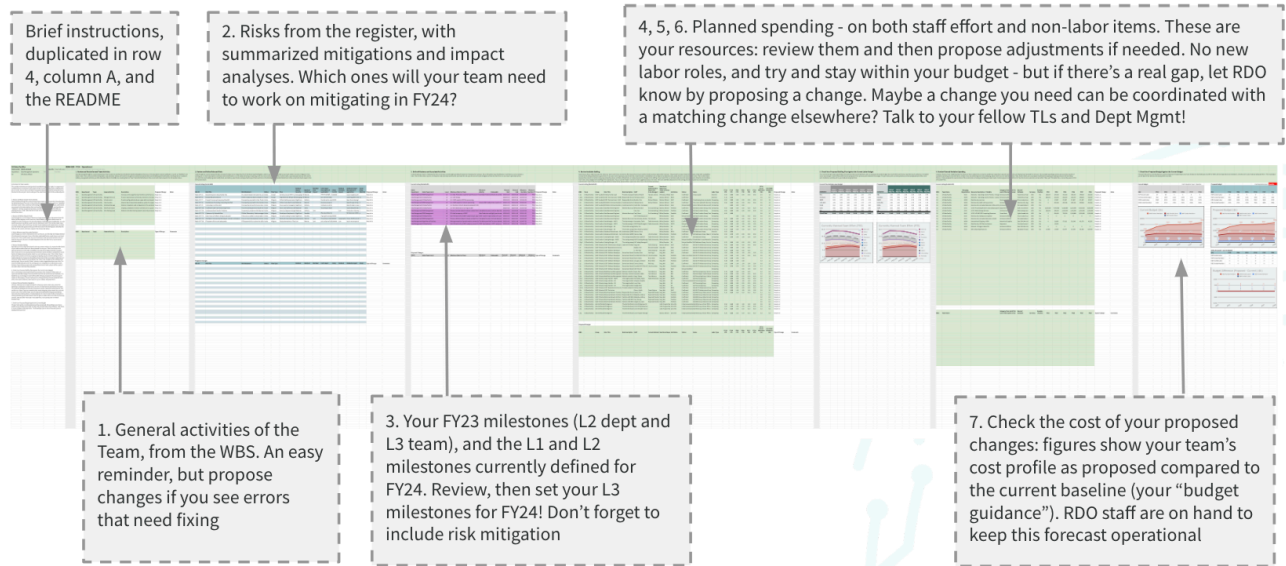


Figure 3. Overview of the Scrub Sandbox tool.

2. risks;
3. Milestones;
4. Labor expenditure;
5. Non-labor expenditure.

Each Team is provided with a sheet within the workbook, that follows a standard layout. The worksheet is organized into 7 vertical sections, where the left to right flow is through each of the aspects in the above list. Within all sections of all worksheets, the tool implements a standard approach to the proposing of changes (see Figure 4). An upper block of cells displays the current plan for that aspect, imported dynamically from the relevant planning tool using the `importrange` command (e.g. the vital information for the risks assigned to a team are read in from the Risk Register). A lower block of cells is then available for proposed modifications to be entered. A Proposed Change column is where any needed changes are flagged, chosen from the drop down choices which are Keep As-Is, Change, and Remove/Replace. There is space to enter a note if explanation is needed. If either the value Change or Remove/Replace is chosen it will require a corresponding entry to be made in the Proposed Changes table lower block.

Proposed changes to the labor and non-labor plan are visualized in monetary terms in real-time with baseline comparison charts such as those shown in Figure 5.

4. OUTCOMES AND CONCLUSIONS

This annual iterative process enables change to happen in a controlled and transparent manner, enabling buy-in at all levels on a) what the upcoming FY priorities are and b) the reasons behind difficult decisions which are often inevitable. It should be noted that changes can still happen throughout the year through a process called Request Beyond Target (RBT), which enables team leads to request mid-year enhancements to their programs. This process is outside of the scope of this paper, but is mentioned here to stress the agile nature of planning at Rubin.

Year on year, as this process takes place from now through to the end of the ten-year Legacy Survey of Space and Time expected in 2037, the scrub process is envisaged to evolve. Each iteration is expected to reveal gaps and areas of improvement that can be fed into the design of the process and the tools for the following fiscal year's scrub.

1. Review and Revise General Team Activities

Start by looking through the current listing of your team's general activities from the Rubin Ops Work Breakdown Structure. If the description needs modification, mark it as "Modified" and leave a note. Then, at the end of the listing down, copy and paste (values, shift-cmd-V) any general activity descriptions that need modifying and modify them, marking them as "Updated". Add any new general activities you think should be listed in the WBS, too, marking them as "New". Note that the full text in the current cell is best viewed in the formula bar above. Hopefully you won't have to propose many changes in this part, this should really just be an easy warm-up exercise.

Current Listing (don't edit, just mark proposed changes plus any notes)

WBS	Department	Team	General Activity	Description	Proposed Change	Notes
3.2	Data Management	US Data Facility		Oversee and manage the Data Facilities' performance	Keep As-Is	
3.2.1	Data Management	US Data Facility	Management and	Provide representation of the Data Facilities to the Data	Keep As-Is	
3.2.2	Data Management	US Data Facility	Infrastructure	Provide configurable hardware upon which are layered	Keep As-Is	
3.2.3	Data Management	US Data Facility	Data Curation	Maintain Rucio-based data backbone system for support	Modify	Moved away from Rucio
3.2.4	Data Management	US Data Facility	Workload Manage	Maintain installation and configuration of the workload	Keep As-Is	
3.2.6	Data Management	US Data Facility	Wide Area Networ	Ongoing collaborative network architecture to support	Keep As-Is	
3.2.7	Data Management	US Data Facility	Alert Vetting Syst	Maintains the Alert Vetting System (code and processe	Keep As-Is	

Proposed Changes

WBS	Department	Team	General Activity	Description	Type of Change	Comments
3.2.3	Data Management	US Data Facility	Data Curation	Maintain Breezio based data backbone system for support	Modification	Switched to Breezio
3.2.8	Data Management	US Data Facility	Tea-making	Make sure all Rubin staff have access to a nice hot cup	Addition	At SLAC deputy director's request

Figure 4. Work Breakdown Structure scrubbing

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Acronyms

Acronym	Description
AST	NSF Division of Astronomical Sciences
ATLAS	A Toroidal LHC Apparatus
AURA	Association of Universities for Research in Astronomy
CERN	European Organization for Nuclear Research
DE	dark energy
FY	Financial Year
NOIRLab	NSF's National Optical-Infrared Astronomy Research Laboratory; https://noirlab.edu
NSF	National Science Foundation
RBT	Requests Beyond Target
SLAC	SLAC National Accelerator Laboratory
UK	United Kingdom
US	United States
WBS	Work Breakdown Structure

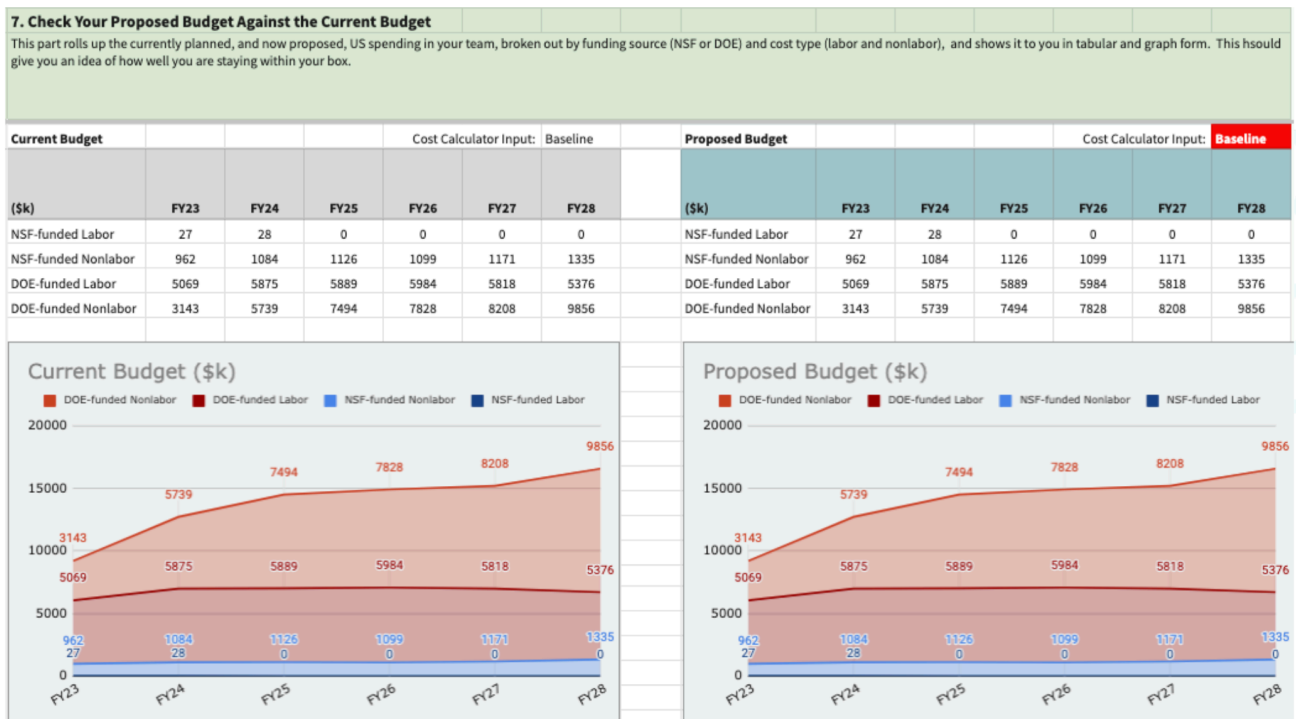


Figure 5. Baseline vs Proposed labor and non-labor comparison