



OCEAN
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INITIATIVE

RISK AND OPPORTUNITY MANAGEMENT PLAN

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Risk and Opportunity Management Plan

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1 OOI Program

The OOI program will conduct transformational ocean science using an integrated ocean observatory with a network of interactive nodes studying interrelated ocean processes on coastal, regional, and global spatial scales and through a continuum of time scales, from microseconds to decades. The facility is funded by the National Science Foundation (NSF) as a Major Facility. The OOI is an outgrowth of scientific planning efforts by national and international ocean research communities over the past two decades and is facilitated in part by rapidly expanding development of computational, robotic, communications, and sensor capabilities.

The OOI program is managed through the OOI Program Management Office housed within the Woods Hole Oceanographic Institution. The OOI will allow transformational science to be conducted to better understand:

- Air-sea exchange
- Climate variability, ocean circulation, and ecosystems
- Turbulent mixing and biophysical interactions
- Coastal ocean dynamics and ecosystems
- Fluid-rock interaction and the sub-seafloor biosphere
- Plate-scale, ocean geodynamics

1.1 Program Goals

The primary goal of the OOI program is to develop an ocean observatory meeting the science plan within budgetary and schedule constraints.

The OOI design relies heavily upon creative, efficient, and effective use of proven, but relatively recent, technologies. Mitigation of risk in this environment must be concerned with; cyberinfrastructure, deployment, operations, and program management.

1.2 OOI Risk & Opportunity (R&O) Database/Register

The OOI Program has funded and fielded a Risk and Opportunity Management Application that supports all aspects of the OOI Risk and Opportunity Management process. It is one of the OOI project management tools available in jira.who.edu. As OOI risks and opportunities are identified, they are entered into the Jira "RISK" Management Application. The application supports the management of all risks and opportunities through their individual life cycles. Management includes activities such as; Risk and Opportunity Management Board (ROMB) meetings, changes in risk/opportunity ratings and is capable of producing a variety of reports, including a Risk Register. This ROMP and the supporting work instructions reference the R&O Database as appropriate.

1.3 Program Risk and Opportunity Management Objectives

The objectives of the risk and opportunity management program is to enable decision making that will reduce exposure to harmful events while also increasing exposure to beneficial events. Risk and opportunity management is defined as a systematic approach to identifying, analyzing, and controlling areas or events with a potential for causing unwanted change and capturing beneficial opportunities. It is through risk management that program risks are assessed and systematically reduced to an acceptable level. Identification and exploitation of opportunities are similarly assessed and pursued.

To develop and implement a Risk and Opportunity Management Plan (ROMP), processes and procedures are established that:

1. Perform risk and opportunity assessment
2. Establish quantifiable, acceptable and achievable risk and opportunity levels
3. Develop and implement handling, mitigation steps and monitoring functions for each risk
4. Define and generate risk and opportunity lists
5. Apply metrics to assess the implementation success of risk mitigation efforts.
6. Identify beneficial opportunities and establish plans for their realization.

1.4 Risk and Opportunity Management Overview

Risk and opportunity management consists of five separate, but interrelated steps shown in Figure 1. The basic set of five steps is executed in an iterative manner to perform OOI risk and opportunity management as a whole.

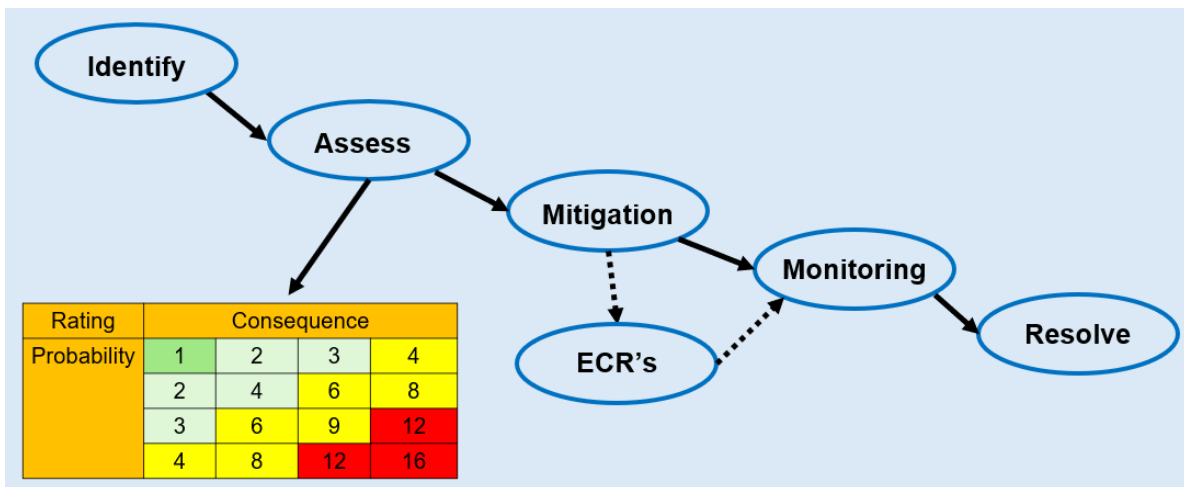


Figure 1, Risk & Opportunity Process Steps

Risk is an undesirable situation or circumstance, associated with uncertainties, that has both a likelihood of occurring and a potential consequence to the program that negatively impacts the Project Management Plan Baseline. Risk management is an organized process to effectively reduce risks to achieve program goals. The process includes risk:

- Identification
- Assessment
- Mitigation
- Monitoring
- Resolution

The goal of risk management is to define and implement methods or alternatives that mitigate risks to an acceptable level. Risks can be “ranked” to depict the most important to the program and consequently requiring management focus.

Opportunity is a desirable situation or circumstance, also associated with uncertainties that can be exploited for the benefit of the project that positively impacts the Project Management Plan Baseline. The same basic risk management process used to mitigate risks is used to realize opportunities. Within the framework of risk management, the goal of opportunity management is to identify positive opportunities

that will reduce cost and schedule while maintaining scope. Opportunities can also be improvement to system performance with little or no increase in cost or schedule. Opportunities are also ranked according to similar criteria used in the risk management process.

Risks and opportunities are included in the Risk and Opportunity Database and are identified, assessed, analyzed, handled, and monitored as described in Sections 4 through 7 of this document. All risk and opportunity actions are subject to ROMB and Change Control Board (CCB) approval.

This Risk and Opportunity Management Plan provides an executive level overview of the OOI Risk and Opportunity Management processes while the risk management work instructions referenced in this document provide detailed implementation instructions. The Risk and Opportunity plans and procedures comply with the guidance provided by the International Council on Systems Engineering (INCOSE) Systems Engineering Handbook, Version 3.0, dated June 2006, which in turn formalizes an adoption of the ISO/IEC/IEEE 16085 Risk Management standard.

2 Applicable Documents

2.1 Guidance Documents

- International Council on Systems Engineering (INCOSE) Systems Engineering Handbook, Version 3.0, dated June 2006
- ISO/IEC/IEEE 16085 Risk Management standard

2.2 Reference Documents

- 1100-00000, OOI Systems Engineering Management Plan
- 1000-00000, OOI Configuration Management Plan

3 Planning

Risk and opportunity planning is the systematic architecting of processes and procedures for reducing or eliminating undesirable occurrences and encouraging beneficial occurrences in programs. Effective risk planning ensures that risks are identified and minimized, alternatives are developed, and time (i.e., schedule) and/or budget are identified to cover the risks that cannot be avoided. Risk and opportunity planning is an integral part of routine project management and Program Management Office functions. It becomes especially important as major scheduled events approach. This ROMP is used to articulate the risk and opportunity management process and provide the framework for executing the process, and is a key deliverable of the risk and opportunity planning process.

Because of the size, complexity, and criticality of the OOI Program, a robust risk/opportunity management process has been established.

3.1 Risk and Opportunity Management Board (ROMB) Charter

The OOI System Level ROMB is hereby chartered for the Ocean Observatories Initiative (OOI) Program and shall operate in the following manner:

- 1) The OOI Senior Project Manager shall function as the Chair of the ROMB.
- 2) The OOI Program Engineer shall act as a "Risk Facilitator" (RF). The RF:
 - Acts as the general administrator or secretary of the ROMB
 - Ensures risk and opportunity items are properly entered into the OOI Risk and Opportunity Management Database (RF can reject a draft risk/opportunity entry prior to a ROMB meeting to get the initiator to add further detail or for other reasons)
 - Schedules ROMB sessions

- Conducts ROMB sessions
 - Generates necessary reports to support ROMB meetings
 - Tracks the current status of each risk/opportunity item
 - Tracks the status of risk/opportunity handling activities against specific risk/opportunity items
 - Ensures session minutes are properly captured.
- 3) Mandatory ROMB members include: ROMB Chair, Risk Facilitator, MIO PM's, and a Financial Analyst from the Project Management Office.
 - 4) Adjunct ROMB members may include any key members of the technical staff and/or program staff that have a vested interest in specific risk/opportunity items. This may also include individuals from the PMO or IO administrative teams who can provide relevant input during the ROMB.
 - 5) Mandatory and adjunct members of the ROMB should present their opinions and provide advice, but the respective ROMB Chairman is responsible for all final decisions.
 - 6) The Risk and Opportunity Management Application in the OOI Jira Application shall be used to enter and track risk and opportunity items, schedule ROMB sessions, conduct ROMB sessions, and capture session decisions/minutes.
 - 7) To regularly identify and monitor risks/opportunities, ROMB sessions are to be held on a quarterly basis at the System Level, unless directed otherwise by the PM or RF. The ROMB meetings shall precede the initial Quarterly Report due dates by at least one calendar week so that a current risk register can be included in the quarterly NSF report. To reassess existing risks/opportunities further additional "Ad-hoc Risk and Opportunity" or ROMB sessions are held if large programmatic shifts in scope or requirements occur, which require a major reassessment of risks/opportunities.
 - 8) ROMB session agendas shall review the current status of selected open risk/opportunity items and the progress of the associated risk/opportunity handling tasks. The RF determines the risk/opportunity items to be reviewed at each ROMB session based on subsystem, risk/opportunity exposure, impact date, and/or other relevant factors. The recommended approach is to begin with the risk/opportunity item that has the highest absolute value exposure and progress through the selected risk/opportunity items toward the items with the lowest exposure. It is recommended that both the risks and opportunities with the highest absolute value exposures be reviewed as a top priority in each of the ROMB sessions and not just the high or medium risks so that high or medium opportunities receive appropriate/near equal attention. The risks and opportunities can be intermingled in order of absolute exposure values or the top 10-15 or so risks can be covered and then the top 10-15 or so opportunities reviewed before moving on to lower exposure value risks and opportunities. The RF shall ensure that over several ROMB sessions, adequate attention is also paid to the lower risks/opportunities.
 - 9) ROMB session agendas shall discuss any newly identified risk/opportunity items; discuss their implications; quantitatively assess the likelihood, consequences, and exposure; activate or reject the risk/opportunity for handling the risk/opportunity where appropriate.

4 Identification

Risk and opportunity identification is the process of exposing the risks that have a realistic potential of harming the program and the opportunities that have a realistic potential of benefiting the program. The focus of the Risk/Opportunity Identification work instruction is to identify, articulate, and capture all major threats and potential benefits to the program plan and the broad range of forces that might impact accomplishment of the plan in both a negative and positive manner. In this context, the plan refers to activities and tasks that must be performed to specify, design, implement, test, deliver, install, and maintain a system (i.e., the Annual Work Plan Baseline). Risk and opportunity identification is not intended to uncover every possible unfortunate or beneficial incident that could happen, but rather to identify significant ones with a realistic likelihood of occurrence, including significant events with a low probability of occurrence (e.g., 10% likelihood of \$10 Million consequence).

There are various techniques used to identify risks and opportunities. "Risk and Opportunity Development" workshops are held on an annual basis as part of preparing the Annual Work Plan (AWP).

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“Emerging Risk and Opportunity” sessions are conducted in conjunction with program milestones such as major technical and management reviews including internal design reviews and formal reviews with the customer (i.e., Conceptual Design Review, Preliminary Design Review, Final Design Review, Life Cycle Objective, Life Cycle Architecture, Initial Operating Capability, etc.).

Anyone associated with the OOI program is encouraged to identify new risks/opportunities by submitting them into the Jira based Risk and Opportunity Management Application. Assistance can be requested from the RF on how to enter the risk/opportunities.

Typically, the OOI program will identify risks and opportunities by analogy comparisons with prototype systems, discussion through the reoccurring OOI ROMB meetings, and by discussion at program management and technical reviews.

New risks and opportunities are entered into the OOI R&O Database with an initial status of “Draft.” A new risk or opportunity can be saved an unlimited number of times as a “Draft” so that numerous updates can be made, the exact wording can be crafted, and the associated Basis of Estimate (BOE) for the Consequences can be recorded that is as detailed as possible. While in the “Draft” stage all fields can be edited, except for the Risk/Opportunity ID, which is automatically assigned by the system. Changes are retained for historical purposes in the draft state.

The RF and other members of the ROMB review new risks and opportunities to ensure they are clearly articulated, the BOE is as complete as possible, and the proper Impact Categories are assigned. Impact Categories are used to group, sort, and bucket risks and opportunities for reporting purposes. Draft risks and opportunities are brought before the appropriate ROMB where they are reviewed and either accepted/opened/entered into the risk register system or rejected. A RF can reject a draft risk/opportunity entry prior to a ROMB meeting to get the initiator to add further detail, make corrections, if it is an exact duplicate of another existing entry or for other reasons.

Each accepted risk item is assigned an “Assignee” who is responsible for analyzing and managing a risk item through its life cycle. The Assignee is responsible for:

- Developing the overall risk handling plan
- Articulating specific risk handling tasks
- Executing and/or managing the risk handling tasks
- Reporting status of the risk handling tasks on a regular basis.

Each accepted opportunity is assigned an Assignee who is responsible for analyzing and managing an opportunity item through its life cycle. The Assignee is responsible for:

- Developing the overall opportunity capture management plan
- Articulating specific capture management tasks
- Executing and/or managing the opportunity capture tasks
- Reporting the status of opportunity capture tasks on a regular basis.

One person does not serve as the Assignee for all of the risks and opportunities managed by a ROMB. Assignees are drawn from the technical or project management staff based on their knowledge and or familiarity with the technical aspects of the risk or opportunity. Several individuals will fill this position at any given time.

5 Assessment

Assessment consists of quantification, characterization, and prioritization of program risks and opportunities after identification has been completed. The goal is to prioritize the list of risks and opportunities and identify those that require the most management attention. OOI uses an assessment (rating) mechanism to apply a quantitative rating to risks and opportunities in a consistent manner as they are identified.

Probability: The RF or Assignee determines the Likelihood for each risk and opportunity.

- Likelihood is estimated on a scale of 1 to 4. Note that 4 implies absolute certainty.

Consequences: The RF or Assignee estimates the Consequences (i.e., potential impact) should the risk be realized or the opportunity captured.

- Consequence is estimated in terms of dollars. A Technical Description/Basis of Estimate (TD/BOE) is developed that 1) provides a textual description of the consequences should the risk be realized or the opportunity captured and 2) quantifies in terms of dollars the Labor, Travel, Equipment, Materials, and Other Direct Costs (ODCs) impacts that will be incurred should the risk be realized or the opportunity captured. The BOE can be elaborated over time but best effort should be made to enter as much detail as possible prior to submission of a risk/opportunity to a ROMB.

Probability: With the likelihood and consequences entered into the OOI Jira RISK database, the system calculates the risk exposure.

- Probability is multiplied by the consequences in to provide a weighted exposure.

Risks and opportunities are classified as; critical high, medium, or low based on consequence, probability and exposure dollar value and Risk Management Board Review.

Risk and opportunity items that have been assessed are maintained in the OOI Jira RISK Database, where their current status is evaluated by the appropriate ROMB at regularly scheduled meetings. The OOI R&O Database creates a risk and opportunity register sorted by the exposure in descending order so the highest risks and opportunities are continuously at the top of the list. Risk and opportunity assessment are repeated for any item when "Likelihood" or "Consequences" change.

6 Mitigation

The fourth step of risk and opportunity management is to analyze individual risks and opportunities. The inputs are risk and opportunity items that have been entered into the R&O Database, approved or rejected by the appropriate RF and/or ROMB, and quantitatively assessed for "Likelihood" and "Consequences." Risk Analysis evaluates alternatives for handling the assessed risks, including performing Trade Studies that examine the change of outcomes with the modification of risk drivers. The evaluations result in the identification of the most critical variables, with insights into desired options for risk handling.

There are four risk/opportunity handling techniques or options.

1. Risk/opportunity control or mitigation actively manages the risk in a manner that reduces the likelihood of its occurrence and/or minimizes the risk's effect on the program or for an opportunity actively manages efforts to increase its likelihood of realization or enhance its effect on the program.
2. Risk avoidance eliminates the sources of high risk and replaces them with lower-risk solutions.
3. Risk/opportunity transfer is the reallocation of risk/opportunity from one part of the system to another or the reallocation of risks/opportunities between the NSF, PMO, IOs or subcontractors.
4. Risk/opportunity assumption or as-is acceptance is the acknowledgment of the existence of a particular risk/opportunity situation and a conscious decision to accept the associated level of risk/opportunity without engaging in any additional control efforts.

Many programs select "control/mitigation" as the risk/opportunity handling technique without seriously evaluating assumption, avoidance, and transfer. This is unwise, since control/mitigation may not be the best technique or even appropriate technique in some cases especially where the control/mitigation costs and effort may exceed the consequences of a fully realized risk. When more than one of the four techniques may be appropriate, a trade study is performed to determine the optimal risk/opportunity handling approach, cost and effort associated with each and the results are presented to the ROMB. The ROMB deliberates on the trade study results to determine the appropriate risk/opportunity handling technique. The final selection or approval of what risk/opportunity handling technique will be made by the appropriate ROMB.

No matter which of the four techniques is selected, a risk/opportunity handling plan is prepared that includes the tasks to be accomplished, a schedule for accomplishing the tasks, resources required, and total cost. For example:

- Avoidance may identify additional design tasks to develop lower risk solutions
- Transfer may identify tasks to restructure procurement plans and associated contracts
- Control/mitigation identifies proactive tasks to reduce the risk Likelihood and/or the Consequences or increase the opportunity Likelihood and/or Benefits
- Assumption may identify courses of action to take if the risk/opportunity is realized

As directed by the ROMB, a risk/opportunity burn down plan is prepared for control/mitigation items that project the remaining Likelihoods and Consequences after the completion of each task in the risk/opportunity handling plan. As necessary, the PMO ROMB requires generating an ECR to the NSF Program Officer for approval when task execution efforts exceed the dollar value thresholds in the *1000-00000 OOI Configuration Management Plan*.

7 Monitoring

The fifth step of risk and opportunity management is to develop plans for monitoring individual risks and opportunities. This includes the implementation of risk/opportunity handling and opportunity capture options and subsequent monitoring to track the effectiveness of the risk and opportunity management effort. Risk/opportunity handling and monitoring deals with risk by authorizing a specific course of action to avoid, transfer, assume, or control each risk/opportunity item. The requirement for reaching this step is not only thoroughly completing the first four steps, but also making available to the ROMB a recommendation for the optimal risk/opportunity handling approach, a risk/opportunity handling plan, and any other relevant material which may play a pivotal role the risk and opportunity decision making.

The RF presents recommended risk handling and monitoring plans or the Assignee presents recommended Opportunity Capture plans to the ROMB. These plans may require the allocation of contingency funds for the risk handling or opportunity capture activities (tasks).

When the recommended plans are approved the RF or Assignee enters the details of each task in the OOI R&O Database, which includes the resulting decrease or increase in Likelihood and Consequences that will be realized upon successful completion of each risk handling or opportunity capture task.

Just prior to every scheduled ROMB meeting, the Risk Analyst updates the status of each risk/opportunity item in the OOI R&O Database, providing the current status for each of the handling tasks as well as an overall summary for the risk or opportunity. Specific emphasis is placed on taking credit for the reduction or increase in likelihood or consequences when a handling task is successfully completed.

Risk and opportunity monitoring includes tracking the effectiveness of risk/opportunity handling actions to document successful actions, identifying ineffective handling actions and bringing attention to risks on their way to becoming actual problems. Monitoring also provides a basis for developing additional handling options and identifying new risks/opportunities. Effective monitoring uses established project management tools, such as the IMS, to provide cost, schedule, and performance management indicators to evaluate the status of risk handling or opportunity capture activities. The OOI Risk and Opportunity Register and reports are designed to provide early warning of potential problems in sufficient time for management to take proactive corrective action.

The ROMB routinely monitors risks and opportunities at their regularly scheduled meetings using a Risk and Opportunity Register (automatically generated from the OOI R&O Database) and an associated agenda that reviews selected active risks starting with the highest risk and working down to the lowest risk. This is followed by a similar review of selected opportunities. Risks and opportunities are retired when the Risk Exposure has been reduced to an acceptable level or when an opportunity has been captured. When a risk or opportunity is retired, the status is set to "Closed."

8 Risk and Opportunity Exposure and Contingency Reporting

Each month the OOI project reports the risk and opportunity register exposure values to the NSF.