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Integrated Risk System

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Abstract

The International Space Station ISS is a complex system technically and programmatically. The Space Station must support a wide range of payloads and missions. It must be launched in many launch packages and safely assembled and operated in the harsh space environment. It is being designed and manufactured by many organizations, including the prime contractor, subcontractors, the NASA institution, and international partners. Finally, the Station has multiple customers, (e.g., the Administration, Congress, users, public, etc.) with contrasting needs and constraints. It is thus ISS strategy to proactively and systematically manage risk to help ensure Program success. The risk management process provides to the program systematic methods for identifying, analyzing, abating, and communicating risks.

Introduction

The purpose of risk management is to identify risks early in the program so that appropriate abatement plans can be implemented to reduce the consequences of the risk or likelihood that the risk will occur. The risk management process provides to the program systematic methods for identifying, analyzing, abating, and communicating risks.

As used herein, “risk” refers to anything which can prevent a team from meeting its objectives. All forms of risk shall be managed, including safety, technical, programmatic, supportability, cost, and schedule risks.

ISS Risk Management Strategy

The strategy of the ISS Program to manage risk is to:

- a. Embed risk management into normal day-to-day activities.
- b. Delegate risk-management responsibility to the lowest teams possible within their allocated resources.
- c. Dedicate a Program Risk Management Team (PRM) to lead program-level risk-management activities, facilitate the risk-management process, and provide analytical support and other risk-management assistance to teams.

Implementation

The ISS Program is managed by a hierarchy of Integrated Product Teams, each responsible for elements of the overall program. As such all program teams are responsible for performing the following risk management functions:

- a. Manage team risks by:
 - (1) Routinely identifying risks.
 - (2) Assessing probability and consequences of occurrence and scoring using the risk matrix tool.
 - (3) Identifying risk-abatement options and analyzing their impacts and uncertainties.
 - (4) Selecting a risk-abatement option and ensuring its implementation.
- b. Report risk-management status and issues to the next-higher-level team, and monitor the risk-management activity of all lower-level teams.
- c. Integrate consideration of risk into all major decisions.

The Program Risk Management Integrated Product Team (PRM IPT) performs the following functions:

- a. Provide to the other teams:
 - (1) Standard risk-management processes and tools.
 - RDMA for managing and communicating risks.
 - Risk scoring tool for assessing risks.
 - Decision trees for structured decision-making that considers risk.
 - Probabilistic cost& schedule modeling.
 - Other new tools as needed.
 - (2) Training
 - Risk card for quick reference.
 - Other forms of team training.
 - (3) Representatives on teams to provide risk management support.
 - (4) Metrics which track the results of the overall risk-management process.
- b. Develop the overall Program risk posture.
- c. Chair the Program Risk Advisory Board (PRAB).
- d. Help teams identify and assess risks which transcend the responsibilities of a single team.
- e. Support program-level risk management by:
 - (1) Performing detailed assessments and cost/schedule analysis on top program risks.
 - (2) Performing other tasks assigned by the Program Manager.

Roles in the risk management process are depicted below:

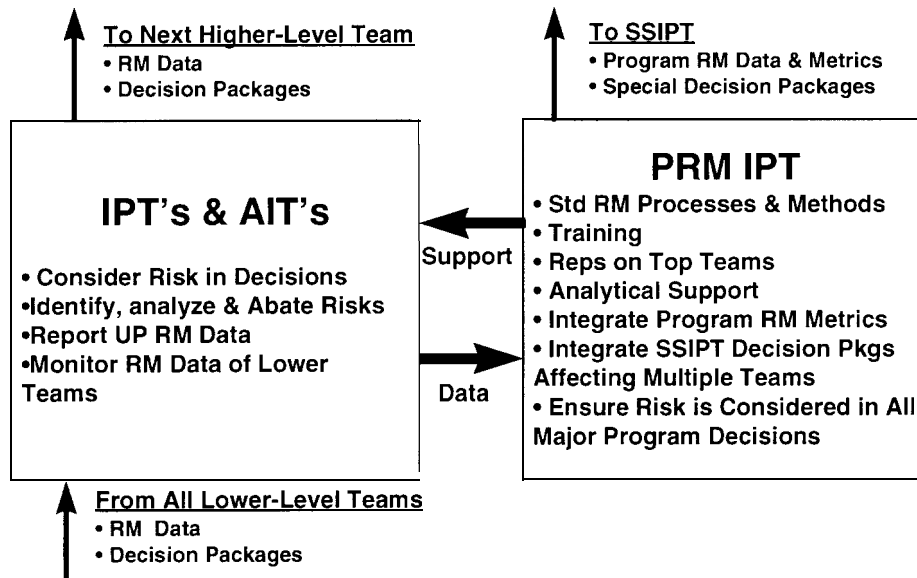


Figure 1 - Risk Management Team Responsibilities

External Assessments

The Chief Engineer, Independent Assessment, and Research Management Office have a unique role in the risk-management process. Risks are identified and whenever possible are communicated to the responsible team as they are surfaced. In the unlikely event that a risk has no ownership, the PRAB will facilitate identification of a responsible team.

Risk Database

The Risk Data Management Application (RDMA), an on-line password protected database, is the ISS program-wide risk database. All Program teams from level 1 (Program Manager) to at least level 4 use RDMA to:

- a. Document and record the status of their team's own risks.
- b. Review their subteams' risks.
- c. Communicate risks vertically and horizontally.

Risks will nominally be entered into RDMA by the team whose product or objective is at risk. This team is referred to as "responsible team". The responsible team (and only that team) maintains data on a given risk throughout its life cycle. When another team identifies a risk, they should report it to the responsible team. If the responsible team is not immediately known, the risk can be entered into RDMA, in which case PRM IPT will facilitate identification of a responsible team. Responsibility can be reassigned by a common parent team or PRM IPT. When reviewing subteam risks, a parent team can provide comments to

the subteam via RDMA and create risks which link to those of lower-level teams. To enhance communication of risks to all teams affected, all RDMA users may view all risks. However, only the responsible team may update a risk.

RDMA facilitates team review of subteam risks. When a team reviews its subteam risks, it records whether it agrees with the data and whether it chooses to elevate that risk. If elevated, this process repeats as high as the Space Station IPT Risks at that level will be reviewed by the Program Risk Advisory Board and approved by the SS IPT. At each level of elevation, teams can assign their own score and rank to a risk.

RDMA is intended as a day-to-day tool for teams. As a minimum, however, teams are expected to review their risks and their subteams' risks monthly and as otherwise required. Teams should coordinate the timing of their review (lowest teams first) to enable rapid elevation capability.

As each abatement task is completed, the responsible team records this in RDMA and restores the risk considering the task's results. By keeping scores updated, a team's current top risks can be readily identified. Once closed, risks will be retained in RDMA and may be viewed for historical reference or audit purposes.

RDMA is an evolving tool and will be continuously improved by PRM IPT with capabilities requested by ISS teams to more effectively and efficiently manage and communicate their risks.

Program Risk Advisory Board

To assist the Program Manager in managing the top risks of the ISS Program a Program Risk Advisory Board (PRAB) has been established. The PRAB has representatives from each level 2 team, the Chief Engineer, Independent Assessment, and International Partners as available. At each monthly meeting, the PRAB reviews the top ranked risks of each level 2 team from the Program Manager's perspective, making changes as appropriate. It develops a ranked top program risks list and reviews abatement plans and status for recommended additional risk-mitigation activities.

The Chief Engineer, Independent Assessment, and Research Management Office presents to the PRAB any risks which they feel lack ISS team ownership. The PRAB facilitates identification of the appropriate owner.

The programs risk management hierarchical review is depicted below.

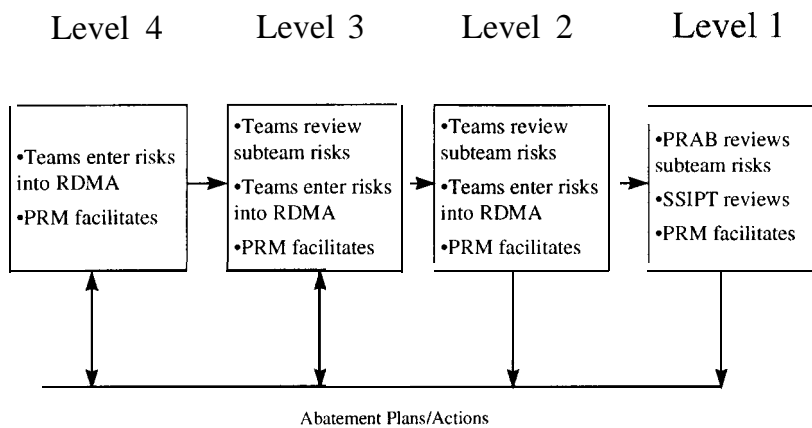


Figure 2 - Risk Management Hierarchical Review

PRM Representatives on Teams

Given that risk management is the responsibility of every team, the role of the PRM IPT is to support the teams in executing that responsibility. As part of that support, PRM representatives have been designated for some 5th level Work Breakdown Structure (WBS) teams and all 4th level teams and above. The PRM representative's primary objective is to assist the team in implementing common risk-management practices into the team's normal processes. The representatives are charged with ensuring that risk management processes are understood and implemented consistently across the program.

Specifically, the PRM representative will:

- a. Ensure that all team members have a thorough understanding of the theoretical constructs that form the basis for the ISS Program Risk Management Process.
- b. Provide the team a tool set for performing basic risk management functions (tools include the risk database, risk matrix scoring tool, decision trees, and probabilistic risk assessment tools, for example).
- c. Provide training on the risk management tools.
- d. Assist the team in implementing the ISS Program Risk Management Process.
- e. Assist the team in formulating abatement and contingency plans.
- f. Assist the team in performing technical analyses, problem solving, and decision making by including the consideration of risk.

Training

The PRM Team provides training information and instruction in risk management and aids for decision making. Personal instruction is available for individual teams from their PRM representative, and generalized packages are posted on the Internet. In addition, any group requesting instruction are supported by briefings or video tapes of group instruction briefings.

Risk Card

The ISS Risk Summary Card, a laminated day planner sized card, provides a quick overview of the risk management process and the risk scoring tool. It provides guidelines and checklists for all steps in the risk management process.

Risk Scoring Tool

The standard risk scoring tool of the ISS Program is the risk matrix. This tool provides a way all program teams can consistently measure risk likelihood, consequence, and magnitude. It allows risks to be ranked relative to other risks to help determine risk-abatement priority. Individual risks can be plotted on the matrix itself to provide a visual representation of their relative magnitudes.

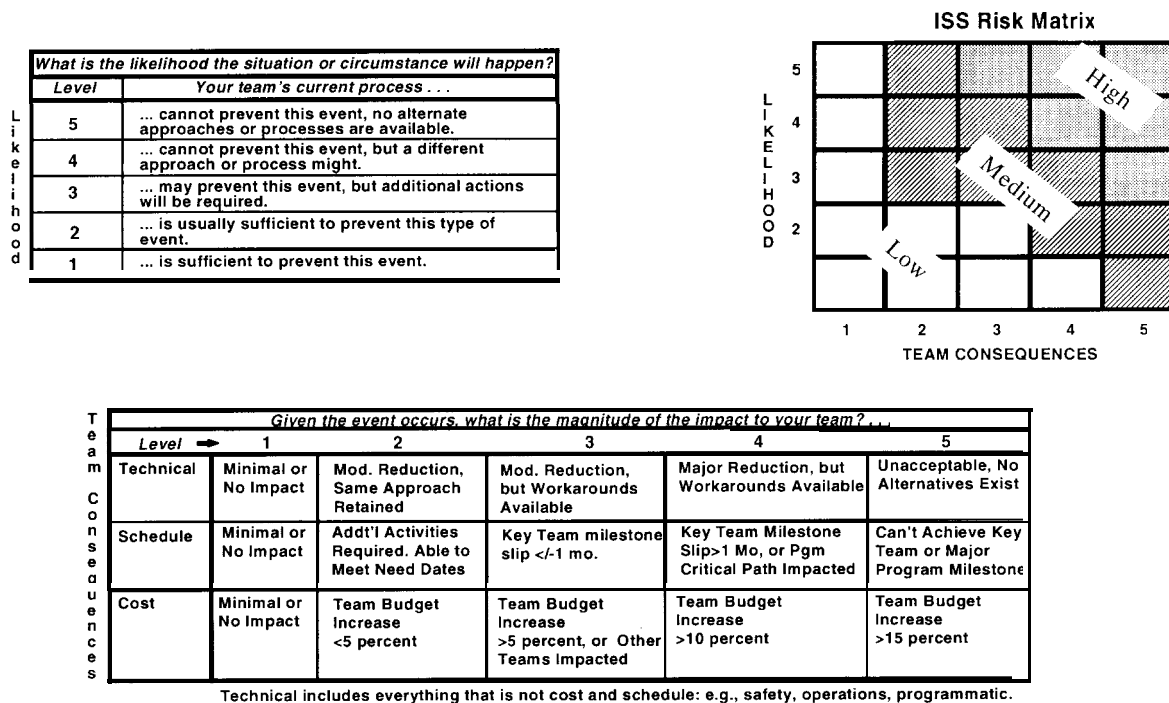


Figure 4- ISS Risk Scoring Tool

Metrics

A number of metrics will measure program risk-management trends using data contained in RDMA. The following metrics are tracked and reported as part of the monthly Program Risk Posture:

- a. Number of new risks entered.
- b. Number of high, medium, and low risks.
- c. Percent 4th-level and higher teams updating risks.
- d. Percent of high risks with abatement plans.
- e. Number of risks without abatement plans.
- f. Percent abatement tasks completed.
- g. Percent abatement tasks completed on time.

Program Risk Posture

Each month, the PRM IPT reports the Program Risk Posture at the monthly Program review. This consists of

- a. The top Program risk list developed by the PRAB.
- b. The risk metrics.

The risk posture development is depicted below.

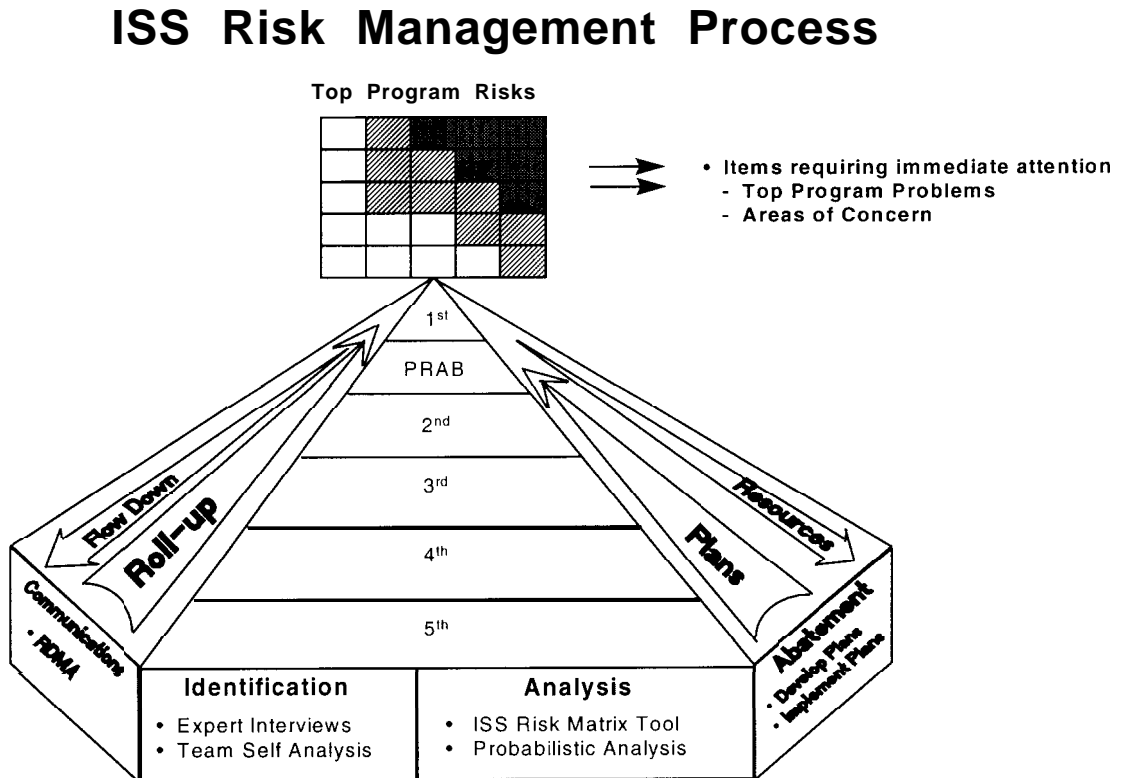


Figure 3- ISS Risk Management Process

SUMMARY

Development programs get into trouble and fail when development risks, both known and unknown become real at a rate and magnitude which cannot be handled within the planned scope of the program. These problems manifest themselves as schedule issues, subsequent cost issues, and possible lack of desired technical performance. The ISS has developed and implemented a risk management process to identify these potential sources of cost, schedule, and technical risks as early as possible; communicate program risks across the program and to customers; and to act on the risks to prevent occurrence or develop contingency plans to minimize their effects. The risk system is the primary methodology for identifying and tracking any situation which may jeopardize the program's success. Currently there are in excess of 400 users representing more than 80 teams actively using the database to track and communicate their risks. While it is still far too early in the development stage to declare success, the ISS is making the most aggressive, forward looking effort to manage risk in the history of NASA Programs.