Risk Management

Risk management balances cost, schedule and performance

THE AEROSPACE CORPORATION

Why do Risk Management (RM)?

- **To balance performance, cost and schedule objectives for program and mission success**
  - Optimize application of program resources
  - Support and document decision-making processes

> “ ***The acquisition strategy shall address risk management. The PM shall identify the risk areas of the program and integrate risk management within overall program management. The strategy shall explain how the risk management effort shall reduce system-level risk to acceptable levels….”*** **(DoD 5000.2-R, C2.5.Risk)**

THE AEROSPACE CORPORATION

What is Program Risk Management?

- **Department of Defense definition**

  "Risk management is the act or practice of dealing with risk. It includes planning for risk, assessing (identifying and analyzing) risk areas, developing risk-handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program." (Risk Management Guide for DoD Acquisition, Defense Systems Management College, 4th Edition, February 2001, www.dsmc.mil/pubs/gdbks/risk_management.htm)

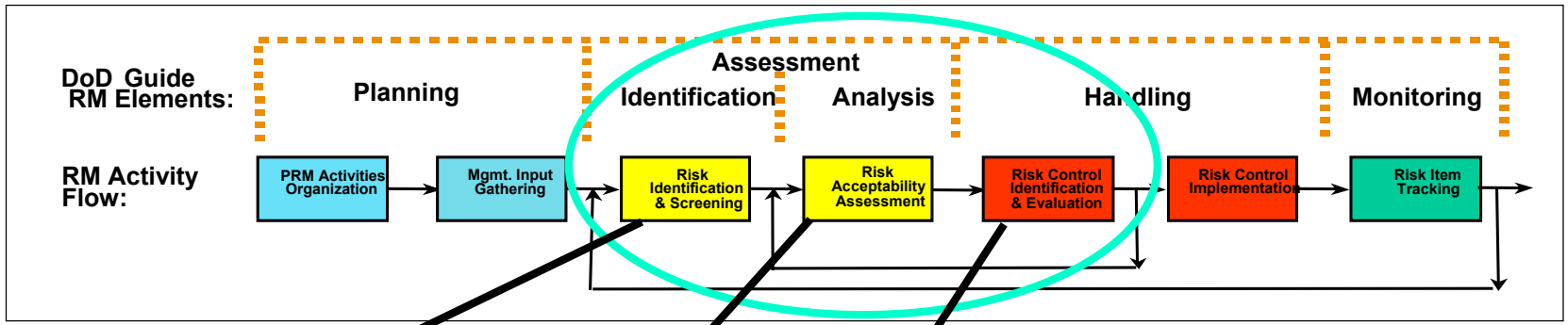
- **NASA definition**

  "Risk Management (RM) is a process wherein the program/project team is responsible for identifying, analyzing, planning, tracking, controlling, and communicating effectively the risks (and the steps being taken to handle them) both within the team and with management and stakeholders." (NASA Risk Management Procedures and Guidelines, NPG 8000.4, April 25, 2002)

How to do Program RM Process (per DoD RM Guide)

Electronic copy at: http://www.dsmc.dsm.mil/pubs/gdbks/risk_management.htm

Key Analytical Stages of Risk Management Process



1. Identification of Risk Items (RI's)

- A. Categorization of program assets, risk initiating conditions, consequences and controls
- B. Definition of RI's by association of initiating conditions, program-asset impacts and resulting program and mission consequences
- C. Identification of existing controls acting on identified RI's

2. Risk Item Screening and Assessment

- A. Qualitative screening → identification and disposition of clearly minor RI's
- B. Qualitative and/or quantitative assessment and analysis of all other RI's, with respect to identifiable "risk acceptability criteria"

3. Identification and Evaluation of Risk Control Measures

- Identification of additional controls to reduce risk from unacceptable RI's
- Assessment of risk-reduction value vs. cost-of-implementation, as indication of practical effectiveness of possible controls

Other Government and Non-Government RM Guidelines for Space Systems Development

- **NASA guidelines**
  - Use somewhat different terminology, but underlying process model is similar to the DoD model
- **RM guidebooks and company-wide RM plans produced by major aerospace companies (e.g., Boeing, Lockheed-Martin)**
  - Usually company-proprietary documents
  - Tailorable to specific program applications and to comply with Government guidelines when applied in the context of a Government-sponsored program

THE AEROSPACE CORPORATION

The Programmatic Risk Management Plan (PRMP)

- **Top level document approved and endorsed by the Program Manager**
  - Formalization of RM objectives
  - Definition of the RM process and activities
- **Tailored for a specific program**
  - Maximize possible risk control results
  - Keep added program burden or costs at a reasonable level
  - Establish metrics (qualitative and quantitative)

"The establishment of a risk management process (including planning, assessment (identification and analysis), handling, and monitoring) to be integrated and continuously applied throughout the program, including, but not limited to, the design process" **(DoD 5000.2-R, C5.2.3.4.3)**

THE AEROSPACE CORPORATION

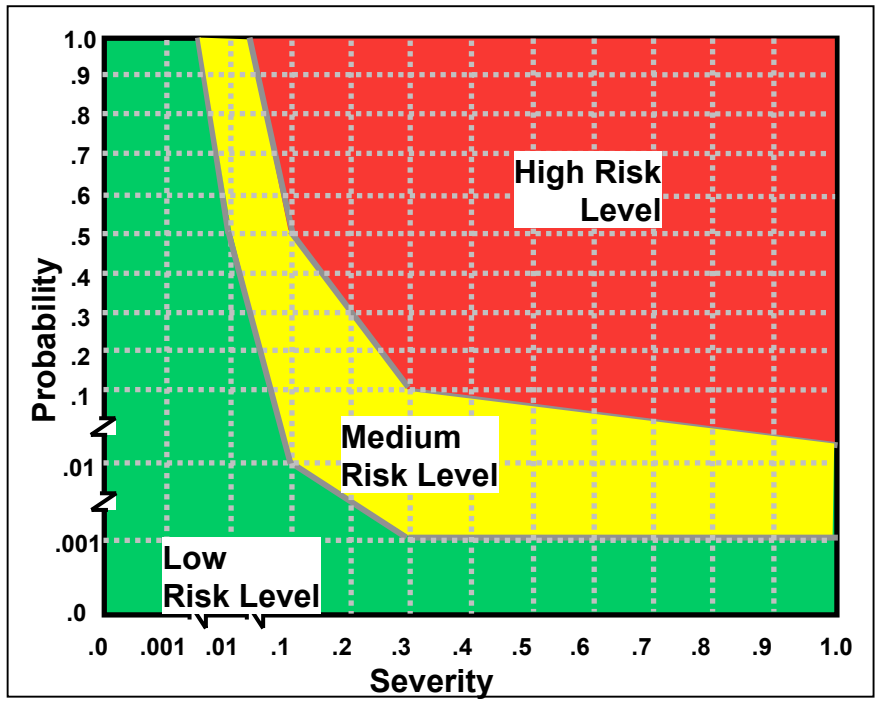
RM Process Decision Points and Criteria

- **Seek program management input to help establish RM decision processes and criteria**
  - Programs have different risk thresholds
  - Qualitative or quantitative definitions of “acceptable risk levels”
    - When to seek risk reduction- when risk items go beyond the risk acceptability threshold
    - Establish “red, yellow and green levels”
  - Risk-reduction vs. cost criteria to establish mitigation/control measures

Risk Evaluation

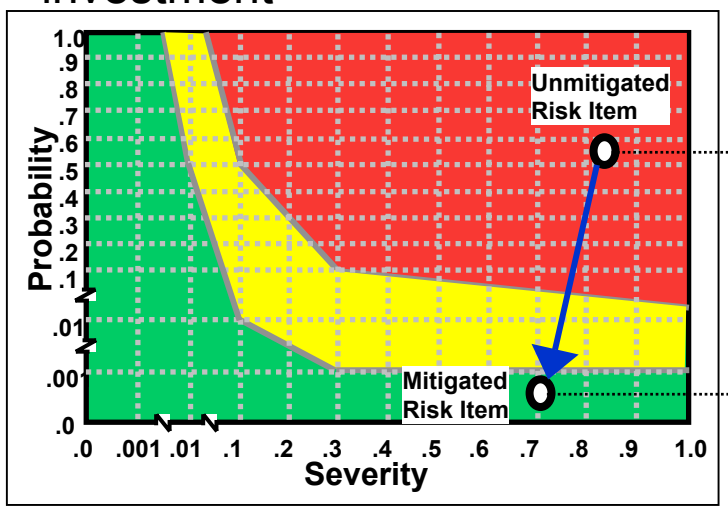
- **Risk-rating should be based on calibrated likelihood and consequence severity scales**
  - **Example: a consequence scale may consider mission or program loss as maximum potential impact and rate other performance, cost and schedule impacts as fractions of such a loss (e.g., each program may identify a schedule delay "programmatically equivalent" to loss of a full mission)**

Severity (> 0; ≤ 1)
=
Performance Loss (fraction of mission loss value equivalent)
+
Cost Impact (other than mission-loss induced)
+
Schedule Impact (fraction of mission-loss equivalent)



Risk Control and Cost-Benefit Evaluation

- **Control/mitigation of risk items is necessary for items above a given risk threshold (e.g., "red" items)**
- **Risk mitigation and control measures for major items is applied from perspective of maximizing benefit (risk-reduction equivalent worth) and minimizing cost (resources and $ needed for implementation)**
  - Saves program resources
  - Focuses mitigation on actions with best risk reduction "return-on-investment"



Cost-Benefit Indices :

Ratio = ΔR / C

Net Benefit = ΔR - C

ΔR = Risk Reduction Worth of a Control = Δ(Prob. X Severity)

(normalized to cost dimension)

C = Implementation Cost of a Control

Use Risk Management as a Program Tool

- **Use RM an integral part of program management practice, as DoD 5000.2-R advocates and prescribes**
  - Make it part of the program management “culture”
- **Take advantage of its processes and tools to balance the allocation of program resources against risk elements and issues**
  - Use it for:
    - Consistent assessment and communication of risk and issues at all program levels
    - Identification of most cost-effective risk-handling strategies and measures

THE AEROSPACE CORPORATION

Education and Development Opportunities

- **Training**
  - Aerospace Institute 3 –Day Course: “Risk Management”
  - National Symposium on Space System Risk Management: 1-Day tutorials
  - Continuous Aerospace Risk Management and Assessment 1-Day “On Demand Course” (contact Aerospace Chief Architect-Engineer Office)
  - Risk Assessment Workshop – facilitated process to lead a team in the identification of risk as a driver for acquisition strategy, RFP, and source selection (contact Aerospace Chief Architect-Engineer Office)
- **Tools**
  - Continuous Aerospace Risk Management and Assessment (CARMA) program (risk data base and assessment software, user’s manual)
  - Other

References

- **Documents**
  - DoD 5000.2R, April 5 2002; www.dtic.mil/whs/directives
  - Directive 1, Contract Management "One Book," Defense Contracts Management Agency, May 2001)
  - Risk Management Guide for DoD Acquisition, Defense Systems Management College, Fourth Edition.
  - SMCI 63-1201: Assurance of Operational Safety, Suitability & Effectiveness for Space and Missile Systems, 21 May 2001
  - NPG 7120.5A, NASA Program and Project Management Processes and Requirements
  - NPG 8000.4 Risk Management Procedures and Guidelines
- **Courses**
  - Aerospace Institute course S3040, Risk Management

THE AEROSPACE CORPORATION