

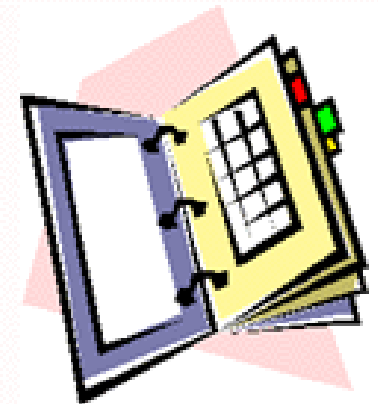


Addressing Risk Effectively

Stephen L. Carman



- Why Risk Management?
- What is Project Risk and How Do You Manage It?
- Risk Management Process
- Risk Management in Your Proposal
- Barriers to Effective Risk Management During Proposals
- Risk Management: Keys to Successful Proposals





Why Risk Management?

Most Projects Exceed Original Budget and Schedule

Sydney Opera House

Budget Overrun 16X

Schedule Overrun 4X



Concorde

Budget Overrun 10X

Schedule Overrun 4X



Boston's Big Dig

I-93 Tunneling under Boston

Budget Overrun 3X (\$14.6B)

Schedule Overrun?

(30 years and counting...)



(Remember: Proposals are projects too)

Customers Require Good Project Risk Management

Customers are demanding continuous risk management on projects

- Up to 33% of proposal evaluation points are risk related

Government Customers use Risk in acquisition selection

- NASA Federal Acquisition Regulations (FAR) supplement now requires “Risk-based acquisition management (R-BAM)” in new procurements
- Risk Management Guide for DoD Acquisition similarly states the increasing emphasis on Risk Management as key to evaluating Department of Defense proposals
- DOE Risk Management practice emphasizes early risk identification as critical to project success.

Risk Management Improves Project Performance

Forward-Looking – Risk management helps projects finish earlier and cost less because fewer problems are encountered

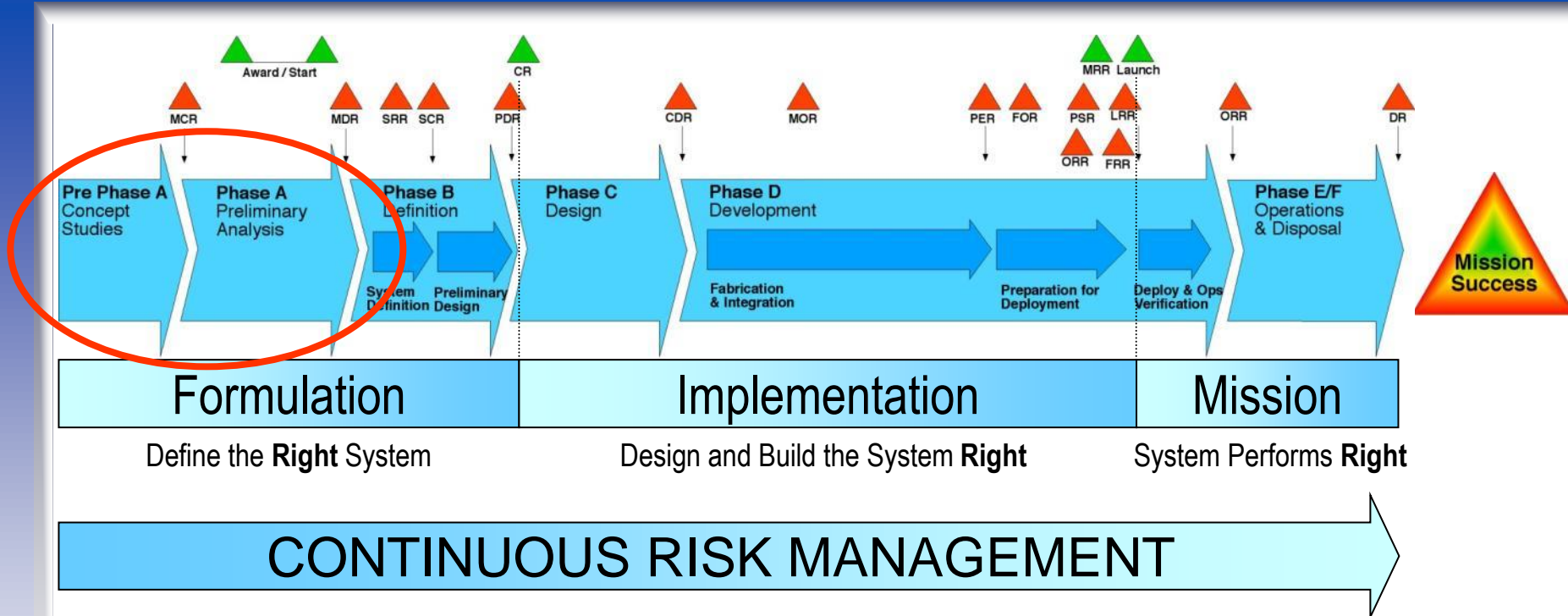
Added Value – A single averted project risk can pay for all risk management activities

- Average cost of risk management: 1 to 2% of project
- The ratio of cost avoided to cost expended on risk management is typically 20:1

Formal Methodology – Risk management is a structured tool for day-to-day decision-making

- Project management is risk management

Manage Risk to Achieve Mission Success

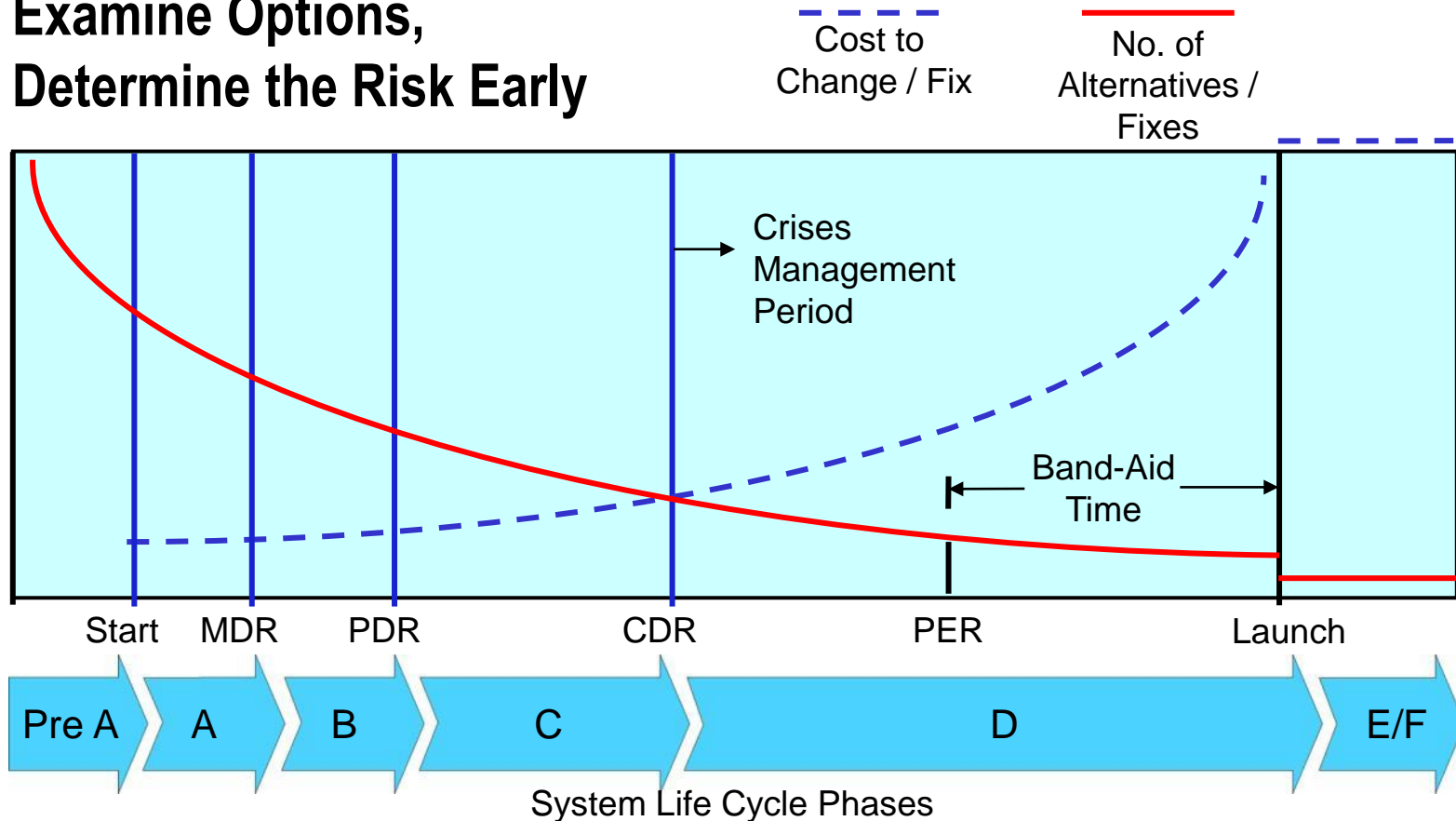


When is the best time to perform project risk management?

- Risk Management continuously supports all phases - *including the Proposal Phase*

Identifying Project Risk: The Sooner, the Better

Examine Options,
Determine the Risk Early



- Risk Management seeks to identify what could be done early to minimize the number of problems later on

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What Is Project Risk and How Do You Manage It?

Definitions and Concepts

General Risk Definitions

Risk is the measure of the probability and severity of adverse effects

- (Lowrance, *Of Acceptable Risk*, 1976)

Risk is a set of triplets that answer the questions:

- What can go wrong? (accident scenarios)
- How likely is it? (probabilities)
- What are the consequences? (adverse effects)
 - (Kaplan & Garrick, *Risk Analysis*, 1981)

What is Project Risk?

Project Risk is a measure of the potential inability to achieve overall project objectives within defined schedule, technical, and cost constraints.

Project Risk has two components:

- The probability (or likelihood) of failing to achieve a particular outcome.
- The consequence (or impact) of failing to achieve that outcome.

Project Risk = function of (probability, consequence)

What is Project Risk Management?

Project Risk Management is the systematic process of planning for, identifying, analyzing, handling, and monitoring project risks and opportunities

- **Minimizing the probabilities and consequences of risks adverse to project objectives**

Risks that can be managed are the known unknowns

The unknown unknowns are risks and opportunities not yet identified or impossible to predict

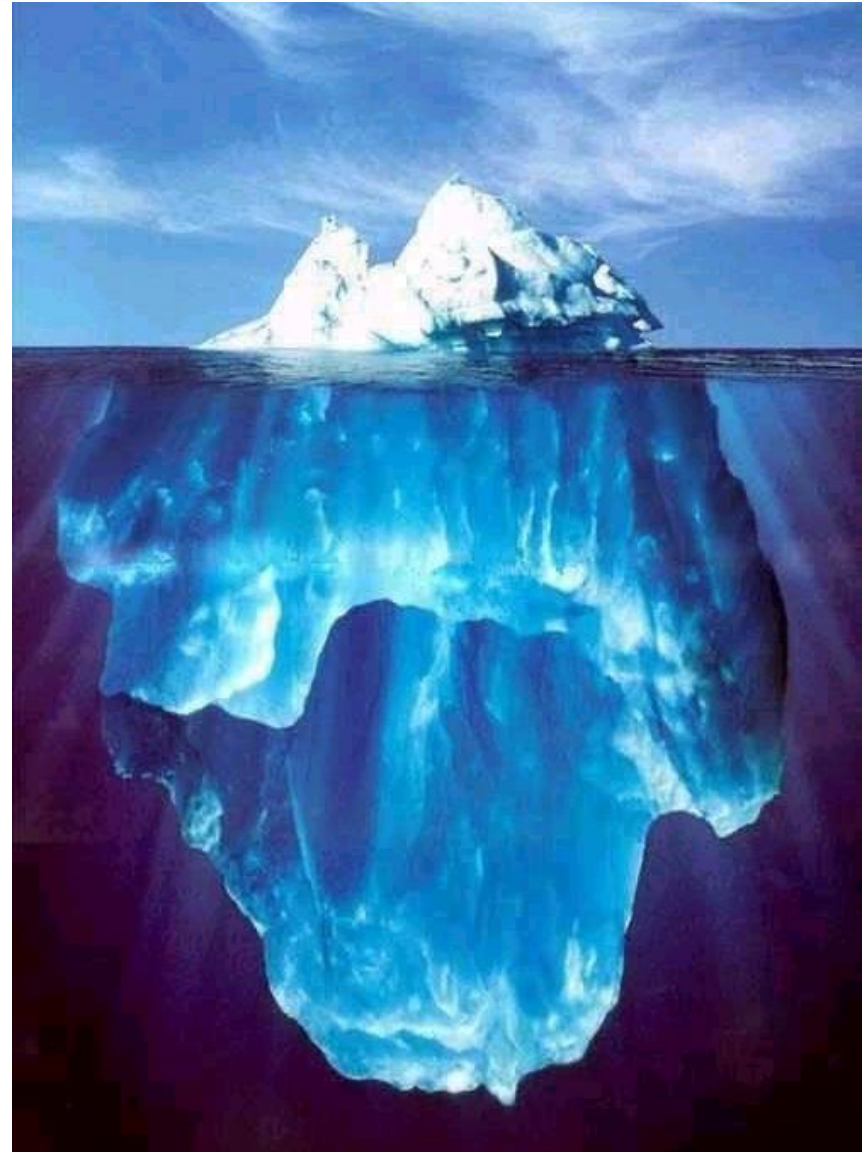
Iceberg Model of Risk Knowledge

Risks already visible
(realized) are **ISSUES**, or
KNOWN KNOWNS

Known risks are **KNOWN
UNKNOWNNS**

Unknown, yet to be
discovered risks are the
UNKNOWN UNKNOWNNS

The **UNKNOWN KNOWNS**
are those risks someone
knows about, *but you don't*



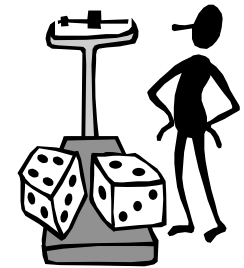
Risk Management: A Simple Idea

Basic idea underlying risk management:

Risk management is a process designed to enable the Project Manager to utilize the combined body of experience of all members of a project team by enabling everyone to **communicate potential risks** that may occur the future of any project activity.

Each of these candidate risks is **analyzed** against pre-defined probability and impact criteria to determine their potential negative impact (risk) on the project.

The risks can then be **prioritized** so that the project resources can be deployed to reduce the largest risks for project success.





Risk Management Process

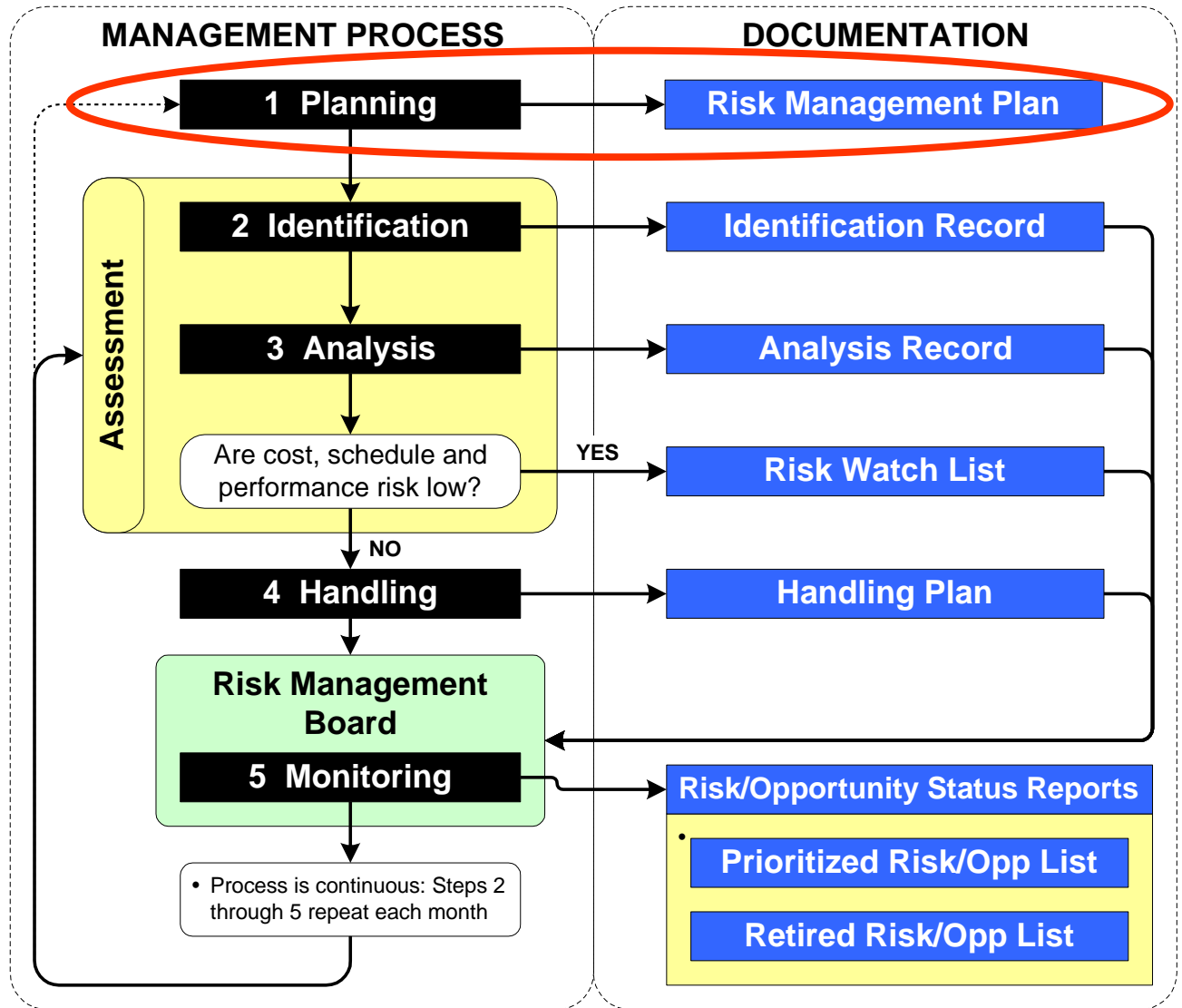
Fire Prevention
Instead of
Fire Fighting

Risk Management Process

Space
Technology
Standard
Process for all
projects from
ATP to closeout

Same process
used during
proposal phase

The Risk
Management
Plan tailors the
criteria for each
project



Tailoring Risk Management Plan Sections

Key sections to be tailored to each project:

- Risk Management Board membership and frequency of risk monitoring reviews
- Risk Scoring Matrix mapping degrees of risk in terms of probability and consequence
- Probability of Occurrence scales, such as a Quantitative (%) scale
- Consequence of Occurrence ordinal scales for cost, schedule and technical performance

A 5X5 Five-level Risk Scoring Matrix

Combines Probability and Impact to obtain a risk score:

Probability	Risk Impact					
	0	1	2	3	4	5
	Nil	Negligible	Minor	Moderate	Significant	Severe
E Very Likely	0	3 Low Med	5 Medium	7 Med Hi	9 High	10 High
D Likely	0	2 Low	4 Low Med	6 Medium	8 Med Hi	9 High
C Possible	0	2 Low	3 Low Med	5 Medium	7 Med Hi	8 Med Hi
B Unlikely	0	1 Low	3 Low Med	4 Low Med	6 Medium	7 Med Hi
A Very Unlikely	0	1 Low	2 Low	3 Low Med	5 Medium	6 Medium

Sample Percentage Probability Scale

The five probability percentages can be tailored to your project, based on acceptable risk tolerance

Probability (%)	Likelihood Rating
> 70	E Very Likely
50 to 70	D Likely
30 to 50	C Possible
10 to 30	B Unlikely
<10	A Very Unlikely

20 Risk Impact Scales

Each risk is evaluated by estimating its impact in three categories: Cost, Schedule and Technical Performance

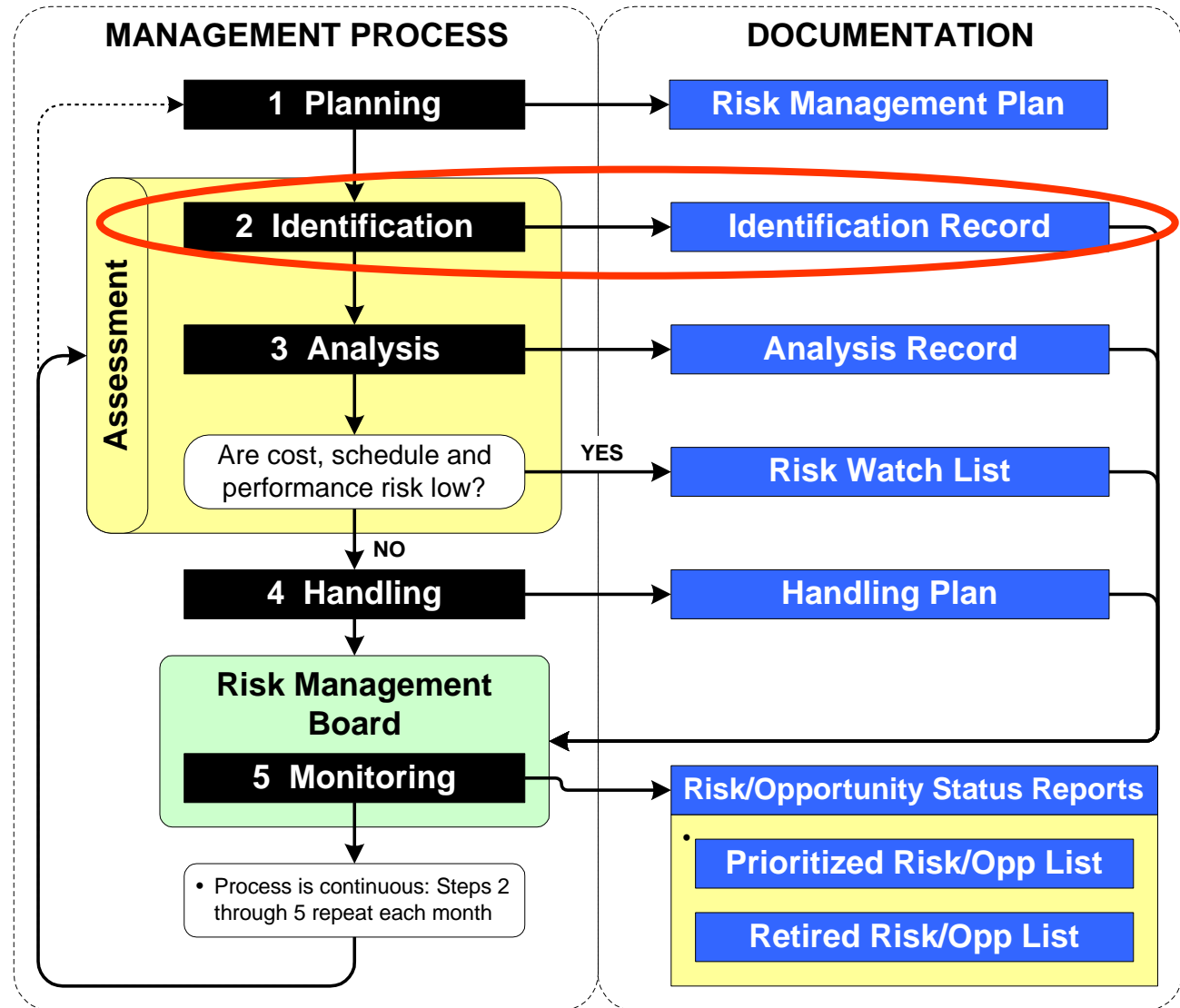
At the time of the proposal, these scales are tailored by the project manager to match the project's estimated budget and duration

	Rating	Cost	Schedule	Performance
RISK IMPACT	5 Severe	Cost increase greater than 20%	Greater than 6 weeks delay in a completion or delivery date	Unacceptable performance will exist. Two or more key performance requirements cannot be met. Major redesign is required.
	4 Substantial	Cost increase of 15% to 20%	4 to 6-week delay in a completion or delivery date	Substantial degradation in performance will exist. One or more key performance requirements cannot be met. Substantial system redesign is required.
	3 Moderate	Cost increase of 10% to 15%	2 to 4-week delay in a completion or delivery date	Moderate degradation in performance will exist. All key performance requirements can be met, but one or more other important performance requirements cannot be met. Moderate redesign is required.
	2 Minor	Cost increase of 5% to 10%	1 to 2-week delay in a completion or delivery date	Minor degradation in performance will exist. All key performance requirements can be met, but margins are inadequate. Minor redesign is required.
	1 Negligible	Cost increase of less than 5%	Less than a 1 week delay in a completion or delivery date	Negligible degradation or no degradation in performance. Performance requirements can be met, and adequate performance margins will exist. Redesign is not required.

Step 2: Risk Identification

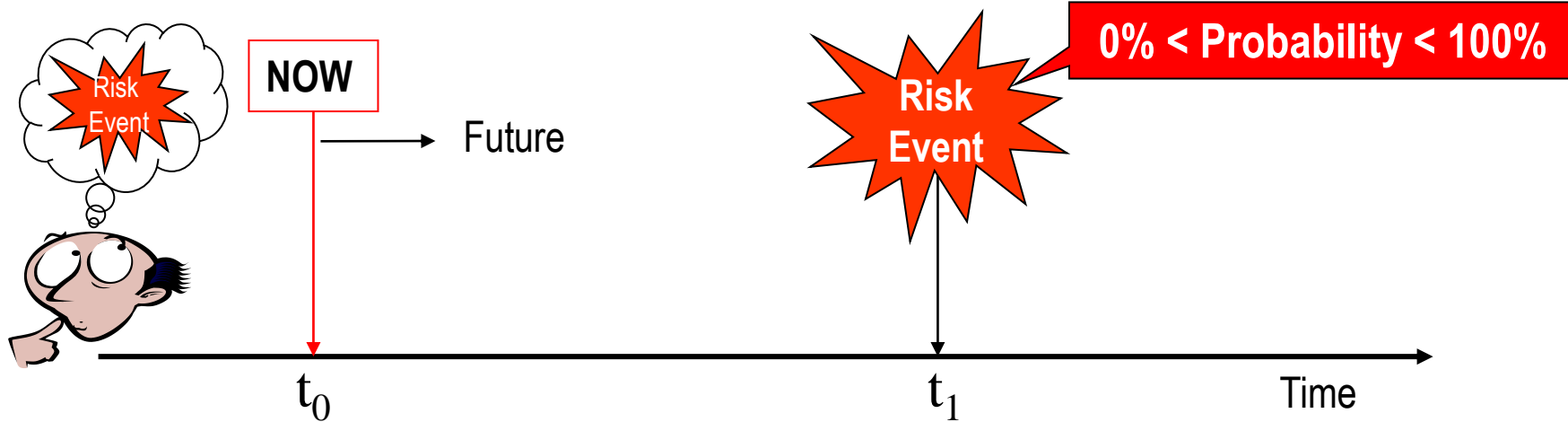
Encourage the proposal team to identify candidate risks as the proposal is being prepared

Brainstorming sessions can produce the initial risk set



Risk Event Identification

A **Risk Event** is an event we can imagine that has some probability of happening in the future that will impact our project:



Probability of occurrence of the Risk Event is estimated and recorded

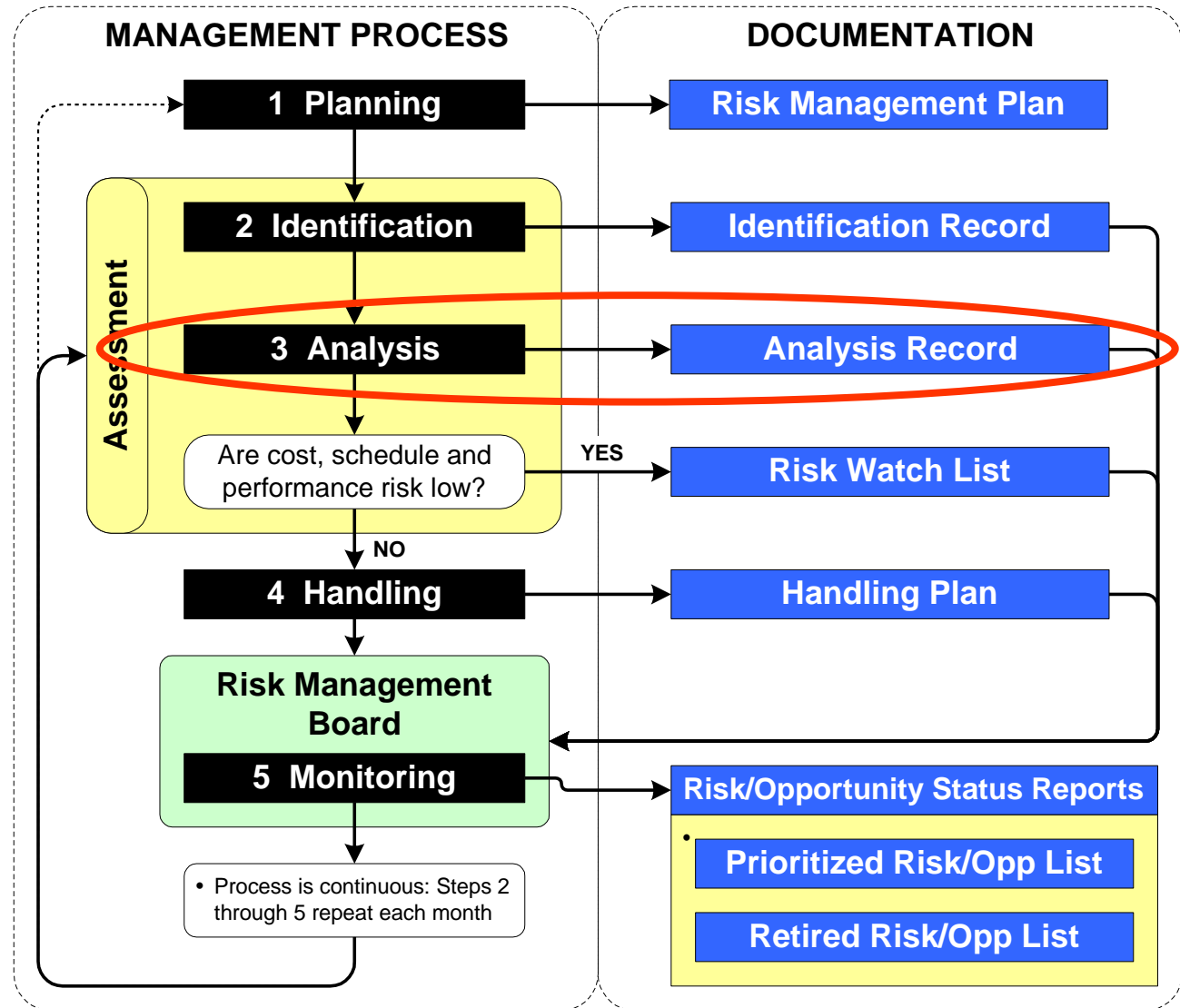
- Probability is between 0% (won't happen) and 100% (will happen)

Step 3: Risk Analysis

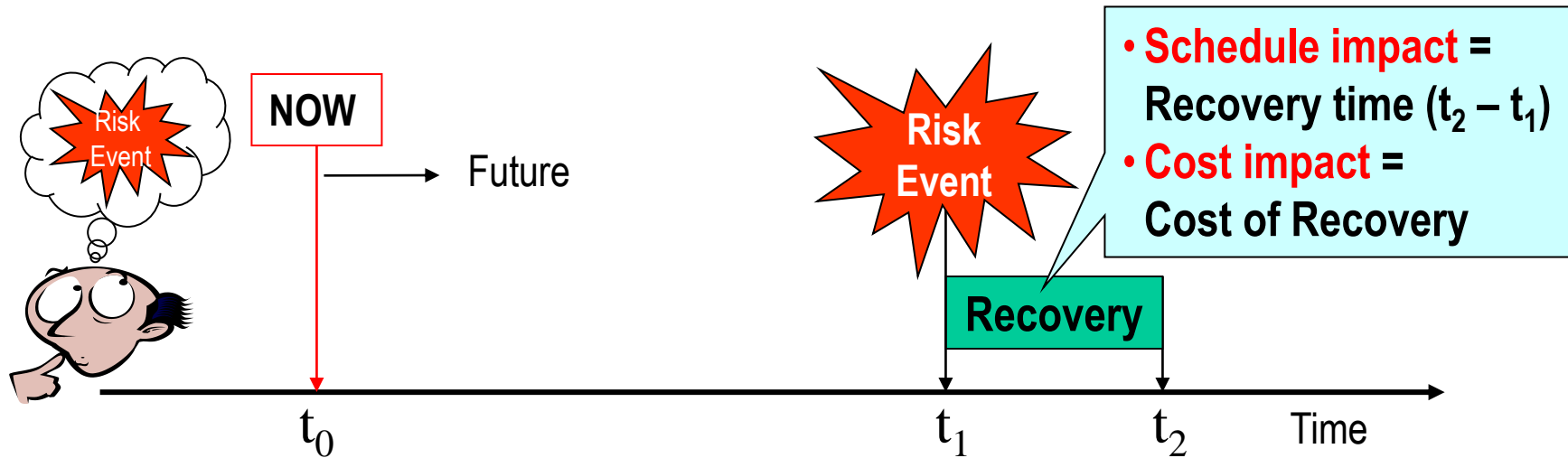
Risk analysis first estimates the cost, schedule and performance impact if the risk occurs

Combining probability and impact, the risk is scored using the risk scoring matrix

Risk is always assessed in time NOW



Estimating Risk Impact on Project Cost, Schedule and Performance

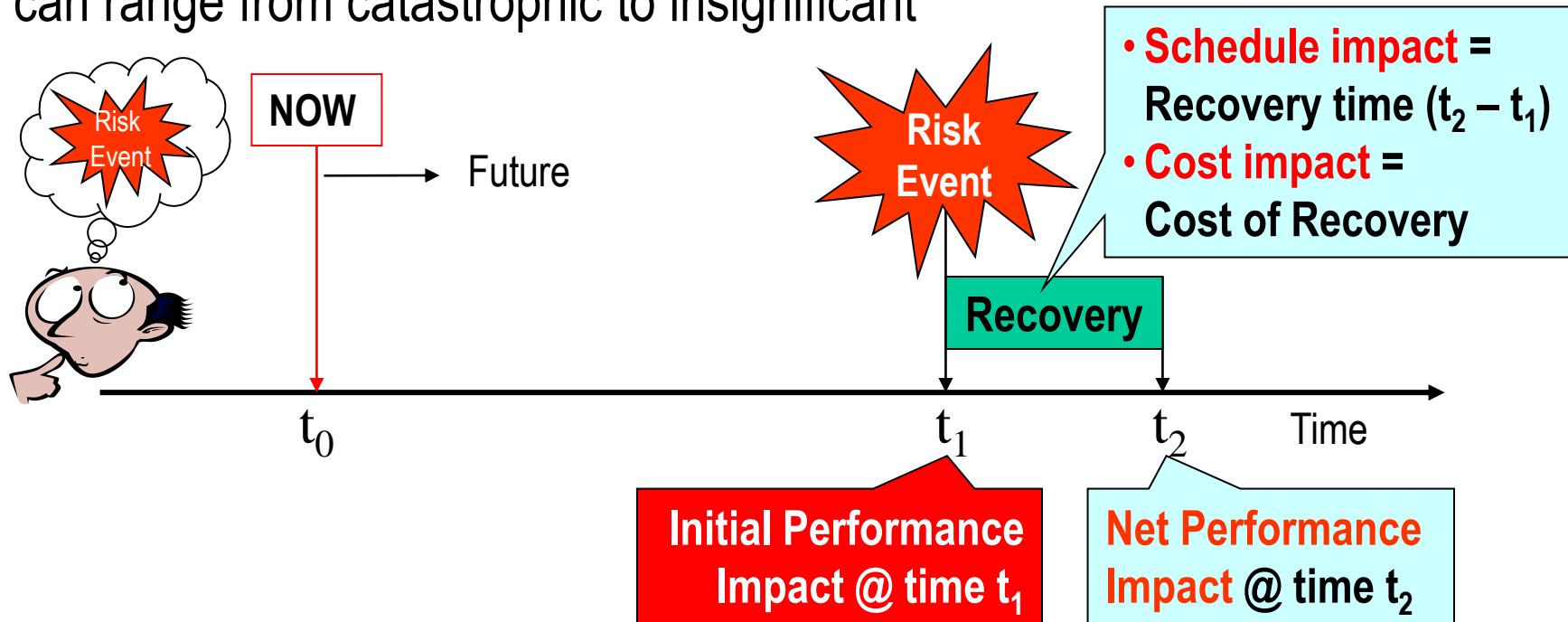


Recovery from the Risk Event impact is the imagined work that would be required to restore intended performance (fix it)

- Assumes nothing is done to prevent it between now and then
- Schedule and cost impact are estimated by imagining the recovery effort

Estimating Risk Impact on Project Cost, Schedule and Performance

Initial Performance Impact imagined at the time of the risk event (t_1) can range from catastrophic to insignificant



Net Performance Impact is the imagined resulting performance at completion of the Recovery activity

- If performance is restored, net impact would be nil or negligible
- If performance is modified by recovery, net impact is scored accordingly

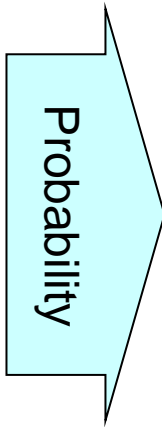
Risk Scoring

Scoring Matrix used to determine three scores:

- Cost risk
- Schedule risk
- Performance risk

Risks can then be prioritized by score

	Rating	Cost	Schedule	Performance
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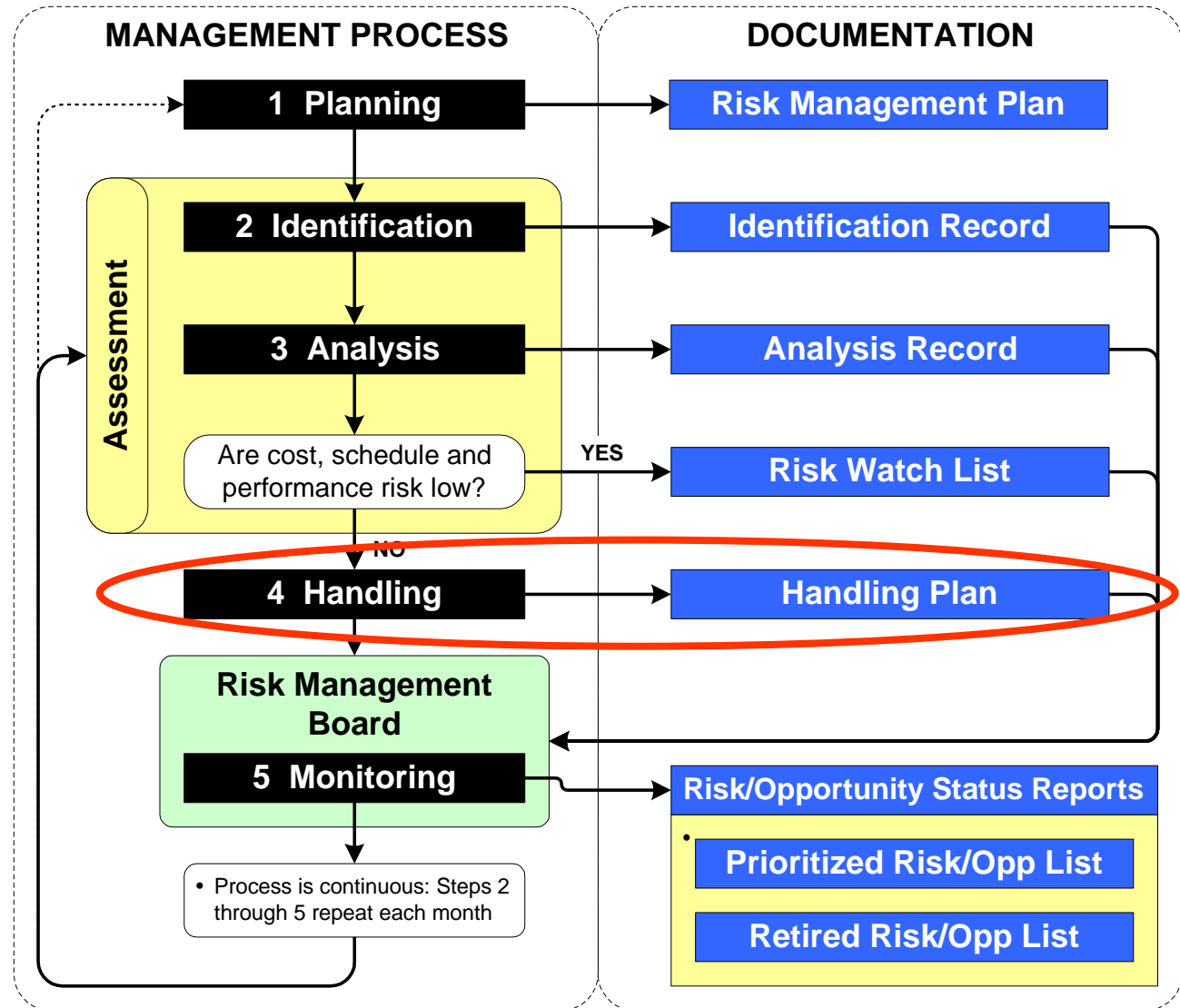


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Step 4: Risk Handling

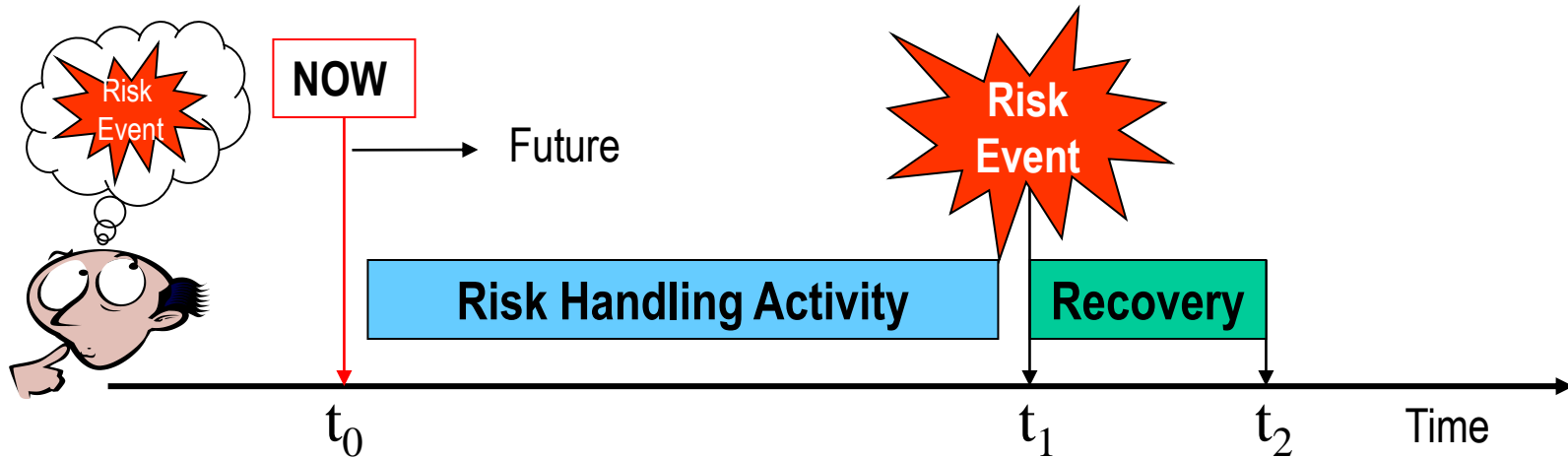
Risk handling plans are designed to prevent or mitigate the risk

Unlike recovery activity that is performed after the risk occurs, handling activity is performed between now and the time the risk might occur



Risk Handling Activity

Handling a risk refers to any activity between now and the time the risk may occur that is intended to reduce the risk probability and/or impact

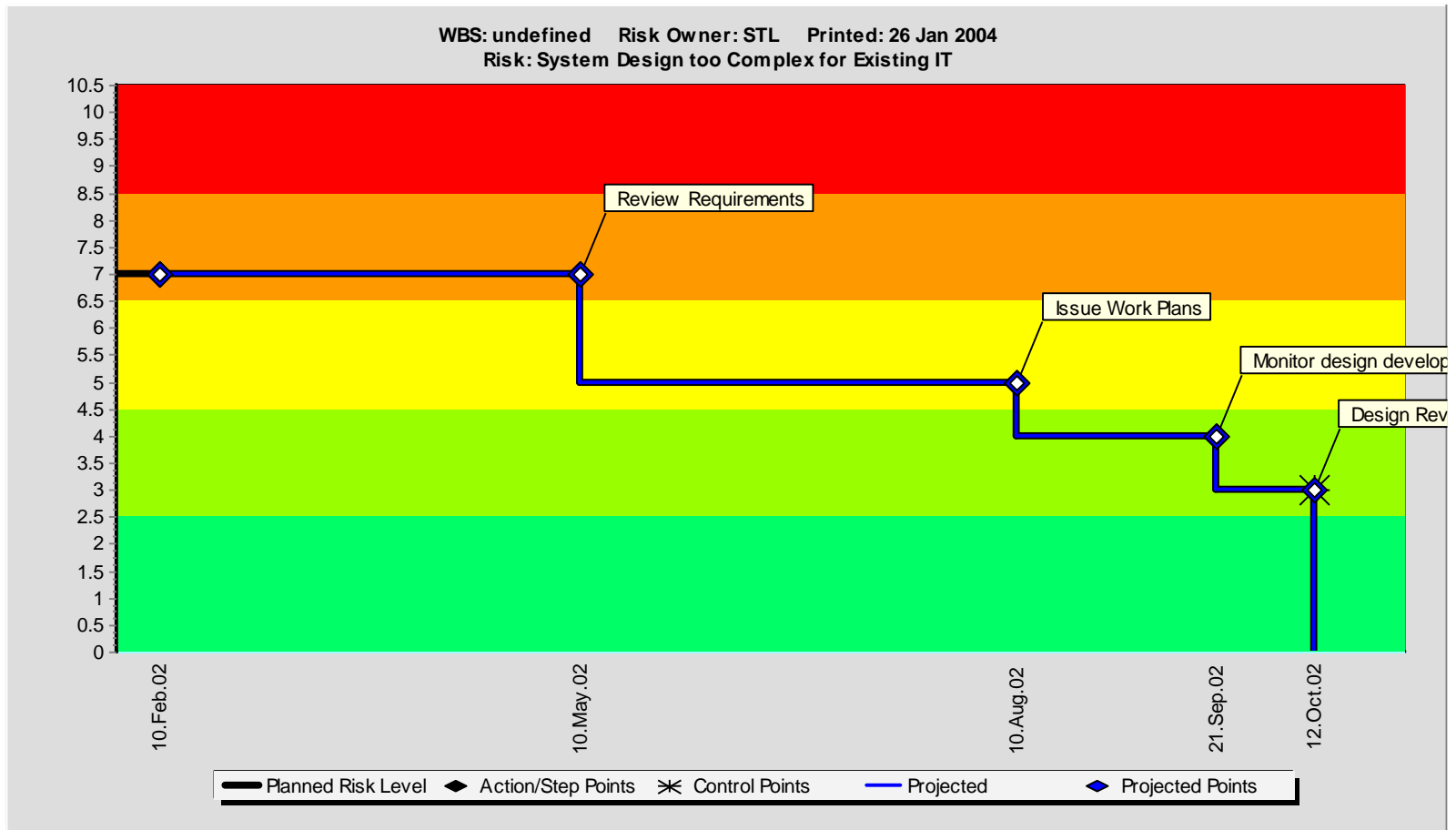


Handling plans may require resources that must be included in the proposal cost and schedule

- If a risk handling step reduces risk event probability or impact, then a risk reduction may occur following completion
- This allows a risk “waterfall chart” to be generated and included in the proposal to illustrate the plan for risk reduction

Risk Waterfall Chart

Waterfall charts graphically forecast the risk handling plan and track actual schedule status

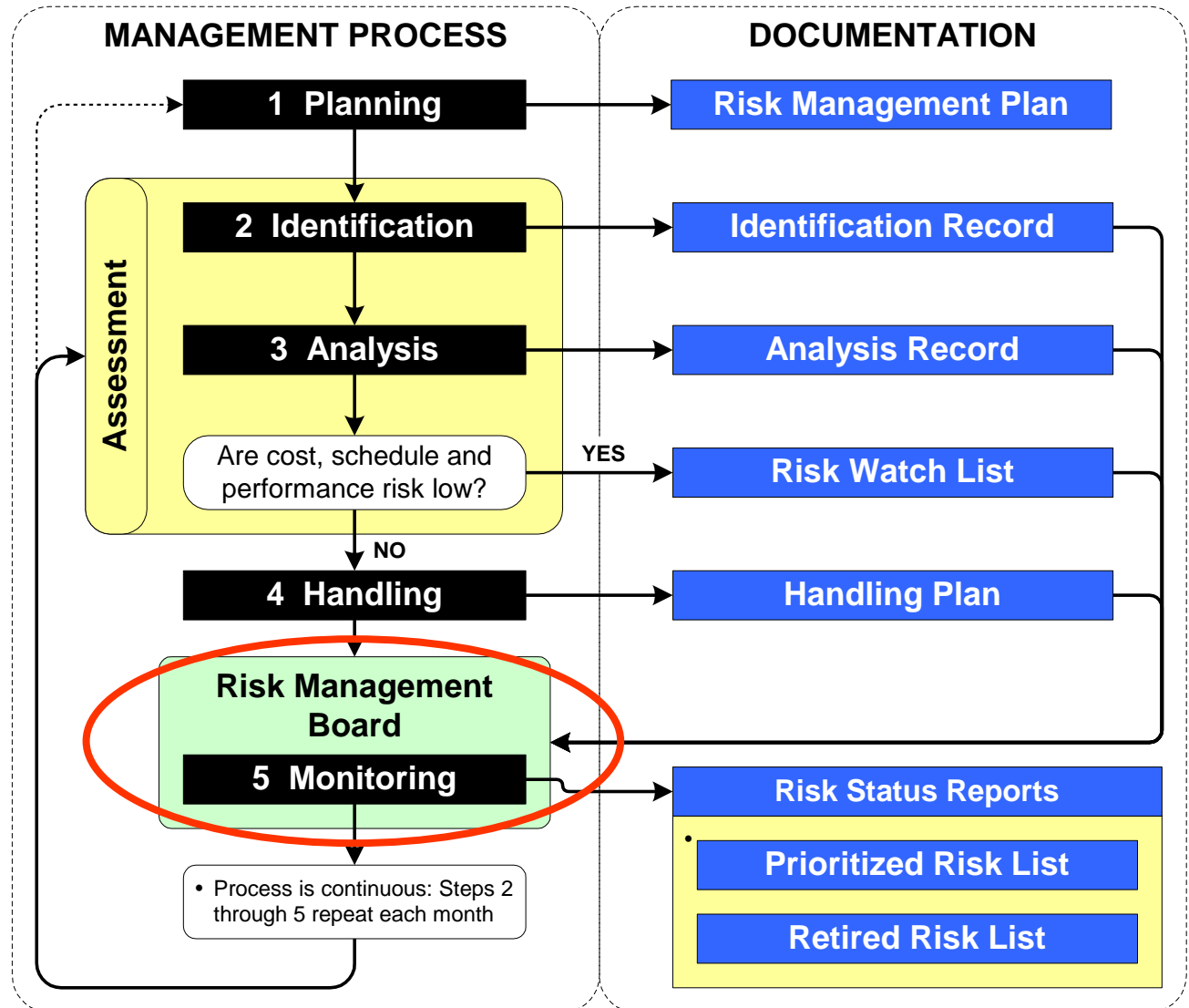


Step 5: Risk Monitoring

Risk monitoring is the periodic review of all risks by the Risk Management Board (RMB)

The RMB typically meets monthly during the project, but may meet weekly during the proposal

Initial risk list is part of proposal





Risk Management in Your Proposal

What the customer likes to see

Typical RFP Risk Management Request

1. Provide an overview of your Risk Management process

- Describe how you will manage risk during the project

2. Provide a description of the project risks you have identified

- Programmatic Risks
- Technical Risks
- Each risk is typically scored high, medium or low based on criteria defined in your process

3. Describe your risk mitigation plans for the risks you have identified

The Risky Business of Proposals

Two Competing Goals will affect the presentation of the risk assessment in the proposal:

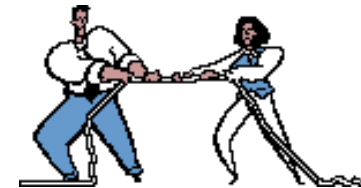
One the one hand, we want to demonstrate we understand the risks associated with the project

- Prepare a complete, prioritized list of risks, scored using the proposed process, with risk mitigation plans

On the other hand, we don't want to imply that there are so many risks or that risks are too high that we appear to be a high-risk contractor

- Red team reviewers often want to reduce the number of risks and eliminate any high risks

Solution: Meet RFP requirements



Be Open and Honest in Assessing Risk

An honest assessment of project risk is important

- Helps make informed decisions
 - Whether or not to bid the job
 - Risk assessment should start during the pre-proposal period as part of marketing analysis
 - How best to mitigate the risk
- Helps management decide how much contingency is needed
 - Risk assessment is key to establishing final price
- Helps Project Manager manage the project
 - The more complete the risk picture, the better are the decisions to avoid or mitigate risk

Risk Management Summary Content

Discuss risk in each technical section

- Identify risks associated with each subsystem and outline the mitigation plans

Present risk management process in project management or system engineering section

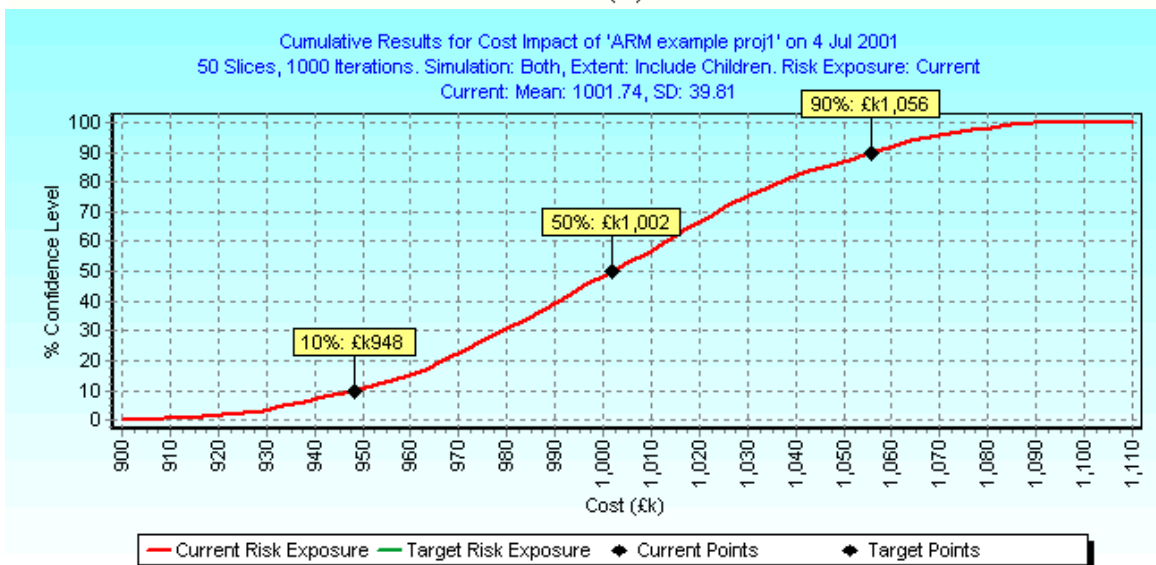
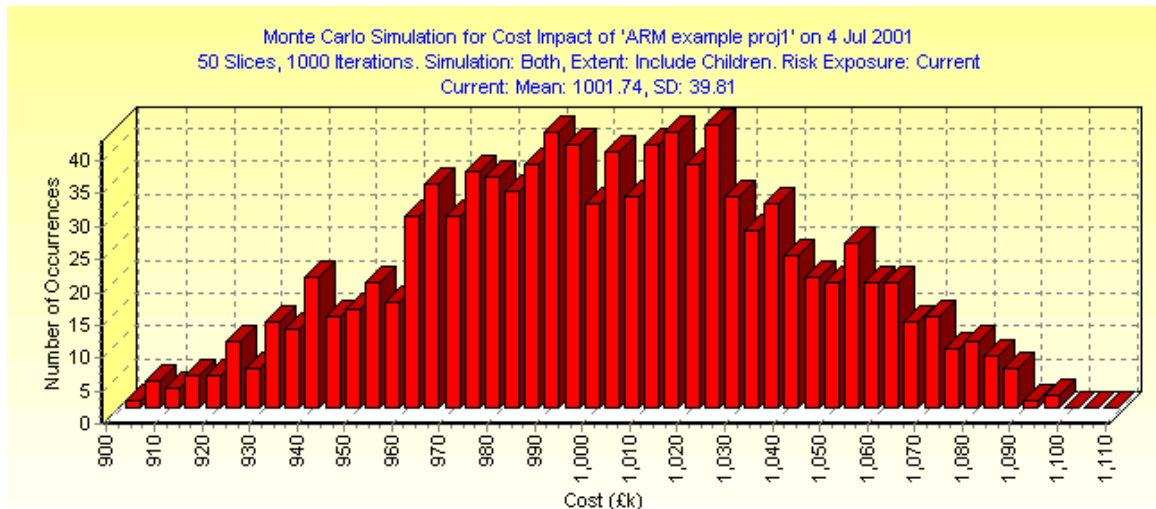
- Provide a prioritized risk summary table:

ERBS Risk Items			Risk Analysis			Risk Handling Plan	
No.	Title	Risk Description	Cost	Perform	Sched	Handling Method	Handling Plan Description
ERBS-005	Electronics Upgrade	System problems listed could occur as late as I&T and after the design and manufacturing phase. Re-purchase of parts, redesign and manufacture might be necessary.	M	MH	H	Control	Evaluate with RTM, EDU
ERBS-003	Detector Qualification	If the JPL thermopile devices fail qualification testing, an alternate source of detectors will need to be identified and potential impact on related electronics will result.	M	M	M	Control	Use RTM for early assessment; Consider alternate source
ERBS-001	Requirements Definition	If mission analyses result in more demanding instrument specifications, then additional design effort will be required with associated cost increase and schedule slippage.	M	M	M	Control	Control: Analysis and alternate design study
ERBS-004	Flex Capsule Availability	If the proposed flex capsule design is not feasible or unsatisfactory in its manufacturability or performance, then an alternate CERES-like design will be required and the EMC performance accepted or addressed in an alternate fashion.	L	LM	M	Control	Evaluate alternate sources

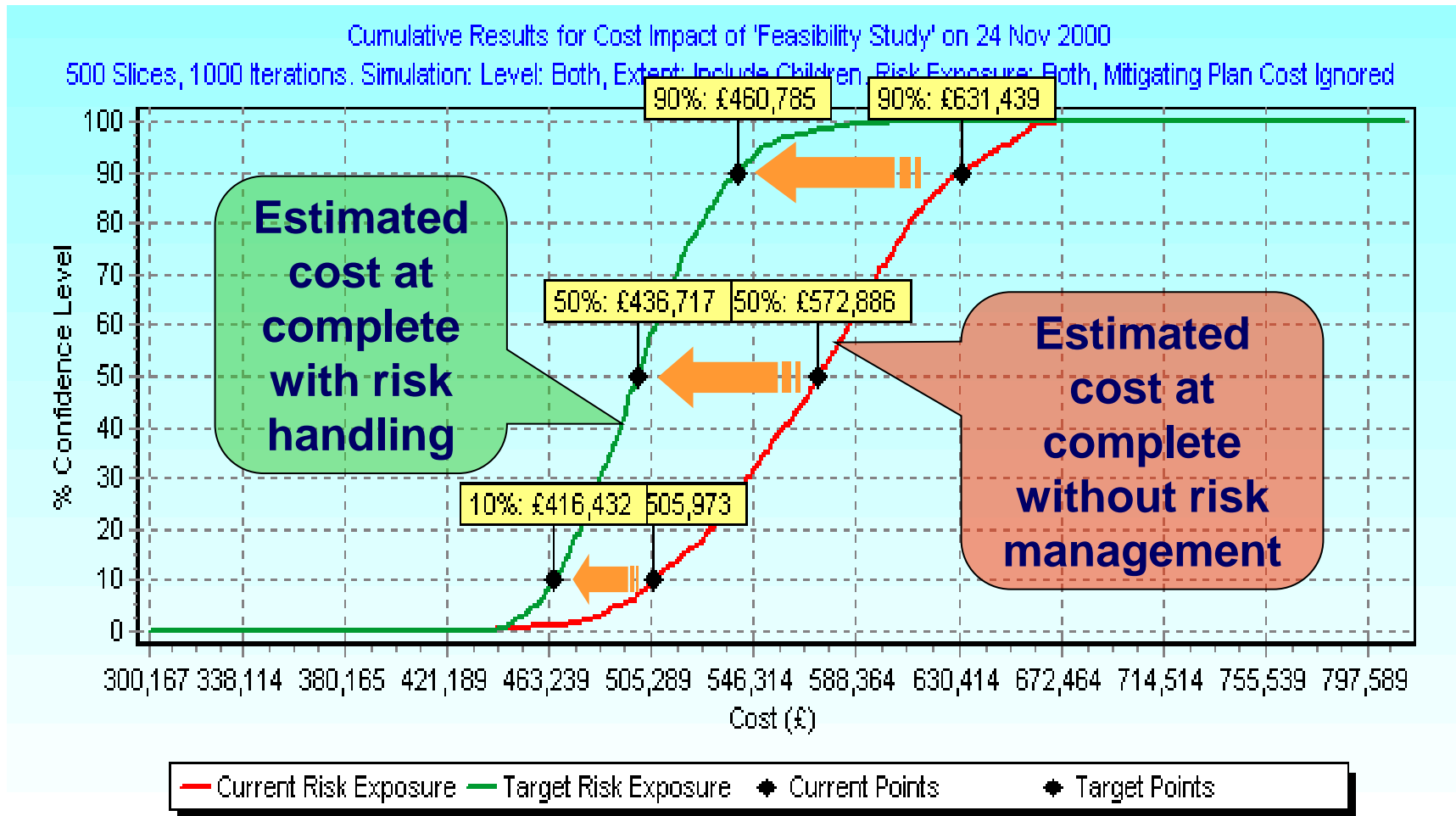
Monte Carlo Analysis Often Useful

**Sample
Cost
Probability
Distribution**

**Sample
Cumulative
Probability
“S” Curve**



Sample Risk Management Cost Assessment Using Monte Carlo Analysis



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Barriers to Effective Risk Management During Proposals

There's Not Enough Time for RM

Completion of a risk management plan, risk identification, analysis and handling takes a lot of time

- Risk management tools can help reduce time & effort

If you don't do a thorough risk assessment, the customer may reject your proposal, or add a lot of cost to compensate for the risks you missed

- Customer's ability to perform risk-adjusted cost analysis is becoming more robust

Monte Carlo analysis can provide insight into overall financial, schedule risk

- Takes more effort, but can be very useful

Variations in Application of RM

Not all proposal or project managers are trained in RM

- Wide variations among proposal team members too

Different proposal teams view risk very differently

- Some teams want to reveal very little risk, fearing customer will think they are unable to perform
- Others want to show comprehensive risk list
 - Programmatic risks
 - Assumption risk, funding risk, geopolitical risk, etc.
 - Technical risks
 - Every part, component and subsystem

Need to establish a common standard practice/process and understand customer preferences

Project Definition Immature

At the time risk impact assessments are made, the project plan is still under development

- Resulting in potentially erroneous estimates of risk impact on early schedule
- Especially secondary impact to critical path

Revisit risk impact assessments when schedule and other elements of the plan are updated

Last Minute Changes Often Affect Risk

You're in the home stretch, the proposal is nearing completion when a decision is made to revise the cost, schedule or both

- At this late date, the risk assessment is rarely updated
- But risk is often increased significantly

Best solution: Revise individual risks impacted by change & reassess overall risk

- *Revisit the Monte Carlo analysis to determine revised confidence level (if available)*
- *Next Best: Make certain the project manager is aware that the proposal risk assessment was not updated after the last minute changes were made*

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Risk Management: Keys to Proposal Success

Address Risk Effectively in Your Proposal

- 1. Establish a standard risk management process**
- 2. Train the proposal team at the start of the proposal**
- 3. Prepare a preliminary Risk Management Plan**
- 4. Conduct proposal team brainstorming to identify risks**
 - Continuously seek additional risks during the proposal
- 5. Analyze and prioritize the risks using your process**
- 6. Develop handling plans to prevent or mitigate risks**
- 7. In the proposal,**
 - Present the risk management process
 - Present a prioritized risk list with scores & handling plans, showing risk reduction waterfall charts
 - Discuss technical risks in each technical section