

Building a Risk Tolerant Schedule

Technical and programmatic disruptions in project plans don't need to negatively impact cost, performance or schedule metrics. But traditional approaches to planning are not an adequate defense. This white paper outlines the six steps for building a risk-tolerant schedule using a field proven approach.

In two prior white papers in this risk management series — “Risk/Opportunity” and “Managing Schedule Risk” — the importance of planning risk management tasks and managing different types of uncertainty in the project schedule was presented. This approach lays the foundation for building a risk tolerant project schedule that identifies programmatic risk and implements the needed mitigation activities.

This paper presents a method for incorporating schedule risk management in a visible manner that provides governance of the project's technical and programmatic performance. This method is based on three core concepts shared by all risk-tolerant plans:

1. Measures of progress must be quantitative rather than qualitative,
2. Normal and foreseen risk handling must be explicitly visible in the plan, and
3. Unforeseen risks must be acknowledged and actions taken when they occur.

Risk Management Structure

The table below describes the Risk Management structure defined in the *Risk Management Guide for DoD Acquisition*. This will be the structure used for developing the Risk Tolerant schedule. It is the Risk Planning, Risk Handling and Risk Monitoring process that forms the basis of this article.

Table 1. – 7 risk management process areas form the basis of an integrated management approach



To build a risk-tolerant schedule, the PMBOK 3rd Edition instructs us to:

- Identify the schedule activities needed to complete the project.
- Sequence these activities in their order of dependency.
- Estimate the resources needed for each task.

- Estimate activity durations using a variety of methods.
- Use this information to create a schedule.
- And control the changes to our schedule.

While this approach appears well grounded since it defines processes that can be used to build the schedule, it fails to address the core weakness of most planning process by not specifically designed to be *Risk Tolerant* in four ways:

1. It is activity-based, not risk mitigation based. Technical risk is identified in PMBOK, but its connection to and with programmatic risk is not defined. [1]
2. It is activity-based, not maturity assessment based. Progress is measured as the passage of time and consumption of resources, not the increasing technical or programmatic maturity.
3. It is activity-based, with no quantitative basis of assessing the risk reduction effort from the current state to completion. Explicit risk buy-down activities are not discussed in a manner consistent with an integrated plan.
4. §11.5.2 of PMBOK describes the recommended activities for Risk Response Planning, but it fails to make it clear how to integrate these mitigation activities in the plan.

Table 2. – Applying risk management to the four attributes of any project – the state of the project, product, process and work – improvements can be made in the probability that the business will receive the benefits from the delivered capabilities.

	Traditional Approach	Risk Tolerant Approach
State of the Project	Progress is measured as the passage of time, the completion of tasks or the reaching of milestones with no quantitative assessment of the technical and programmatic maturity of the project.	Maturity Events provide not only a review of the progress to date, but also an assessment of the readiness of the project to proceed to the next step. The fidelity of a design, a fabrication or an operational capability can be assessed at each project Event.
State of the Product	There are no quantitative measures of completion other than they are “done.”	The Significant Accomplishments that define the increasing maturity of product elements are explicitly stated in quantitative terms.
State of the Process	No specific process measures are provided in the plan.	The Accomplishment Criteria – exit criteria – by which the state of product is measured, are explicitly defined as the conditions of completion for each accomplishment.
Work Delivery	Tasks describe the work necessary to complete the project. When all the tasks are done it is implied that the project is done.	Only those tasks that support the completion of the exit criteria are defined in the plan. They are discrete work. All other work is defined as level of effort, since it has not specific defined outcome.

Measurable Maturity and Embedded Risk Management

Building a Risk Tolerant schedule starts with understanding that the traditional approaches to planning described above, leaves out of the plan the very elements needed for risk tolerance. These elements start with the identification and assessment of the project, product and process states as part of the schedule.

Steps in Building a Risk Tolerant Plan

1. Define the measurable maturity Events of the project. These assessment points can be determined in terms of capabilities or fidelity of the deliverables agreed to by the customer. Capabilities describe a defined outcome that is not the final conclusion, but lays the groundwork for the continued delivery of value. [2] Objectives are reached and the operational value delivered when a defined capability is available for use. Features and functions describe the static and dynamic behaviors of a system, but they are not directly connected to a strategy, mission or vision defined in the chartering session of the project. Milestones indicate the arrival of a point in time. Capabilities

delivery provides an answer to the question: *in order to achieve the objective of this project, what capabilities must be possessed?*

2. Define the Significant Accomplishments and the Exit Criteria that deliver the needed capabilities for the project. A capability is defined for each point along the maturity line – from immature to complete. Each Significant Accomplishment and its Exit Criteria needs to be worded as a past tense statement about the delivery of an end item. This delivery must be 100% of some defined result. No percentage complete is allowed! Rather 100% of a partially defined capability, product, or service clearly states what “done” looks like at each place along the way to completion of the project.
3. Define the work needed to deliver the Significant Accomplishments and their Exit Criteria. This provides the focus needed to define what “done” looks like for each exit criterion. These tasks should represent the vast majority of the activities in the plan. Any

other work should be classified as Level of Effort.

4. Rank each task according to an ordinal risk scale. Each task must be ranked since, it is not clear in the beginning which tasks will be critical to the completion of the schedule, which ones will interact and cause programmatic risks to appear.
5. The ranking of risk. Six basic classes are commonly used. [3] The probability scales commonly used are un-calibrated in most instances. These types of scales (un-calibrated) generally produce poor results unless the process is well structured, stable and repeatable.

Table 3 shows how calibrated ordinal scales can be defined for various risk domains. [4]

Table 3. – Uncalibrated ordinal scales should not be used to rank risk. Instead specific descriptions of the meaning of *High*, *Low* and the ranges between should be stated

Domain	High Risk Example	Low Risk Example
Maturity	Basic principles observed	Item are deployed and operational
Sufficiency	Research required	Processes defined and operational
Complexity	20% of interfaces defined	Less than 5% of design altered during final review
Uncertainty	Frequent changes in requirements	No changes in requirements
Estimate	No chance (< 5%)	Certain (> 95%)

6. Define the explicit tasks to mitigate the known risks. These are risks with a probability of occurrence and a probable impact. These tasks should be placed in front of Significant Accomplishments to provide a buffer or time for correction.
7. Define alternative paths through the schedule for unknown risks – risks with a probability of occurrence but with an unknown impact. These paths are indicated as branching probabilities in the plan.

The result is a plan where risks and their mitigations are visible with risk ranking for each task delivering results for each Exit Criteria.

Processes and Practices

“Risk monitoring is the process that systematically tracks and evaluates the performance of risk–handling actions against established metrics throughout the project and develops further risk–handling options, as appropriate. It feeds information back into the other risk management activities of planning, assessment, and handling.”[5]

If monitoring is passive, then it is just a bookkeeping function. Proactive risk monitoring provides quantitative information to decision makers through variance in the Cost, Performance, Schedule and changes in the risk analysis data. Earned Value provides cardinal values for Cost and Schedule (C-S) metrics. Technical Performance Measures provide cardinal values for Performance (P) metrics. The C-P-S cardinal values are the basis of a continuous risk management process by aligning risk reduction tasks with the Significant Accomplishments and their Exit Criteria.

These risk monitoring metrics provide adjustments to the risk handling strategy and the Risk Handling Plan and provide information to update the risk probability and risk consequence portion of the risk analysis.

Learning to create a risk tolerant schedule and managing the technical and programmatic risks represented by this schedule is a practice. A high technology program manager once noted, “You can’t learn surgery from reading a book — you need to successfully complete a surgical residency.”

No amount of attending seminars or reading books or articles (even these articles) will provide the solution to managing schedule risks. But there are two good starting points: *Risk Management Guide for DoD Acquisition, Fifth Edition (Version 2.0)*, Department of Defense, Defense Acquisition University, June 2003, and *Effective Risk Management: Some Keys to Success*, Edmund H. Conrow, AIAA Press, 2003.

These are recommended practicum guides. PMBOK®, while introductory in nature, does not provide an integrated approach to Cost, Performance, and Schedule risk management.

There are other texts that should be on the shelf of any competent risk management professional, including: *Making Hard Decisions*, 2nd Edition, Robert T. Clemen, Duxberry Press, 1996; *Introduction to Statistical Decision Theory*, John W. Pratt, Howard Raiffa and Robert Schlaifer, MIT Press, 1995; *Quantitative Risk Analysis*, David Vose, John Wiley and Sons, 2000; and *Practical Risk Assessment for Project Management*, Stephen Gray, John Wiley and Sons, 1995.

Bibliography

[1] PMBOK®, the British Standards Institute, and the UK Institution of Civil Engineers as well as numerous internal risk management handbooks combine risk and opportunity into single assessment criteria. It could be argued that risk includes both opportunities and losses. However, there is rarely an opportunity without the possibility of loss. On the other hand there is almost always a chance of loss without opportunity. The PMBOK approach changes the definition of risk: the potential for the realization of unwanted, negative consequences of an event. Opportunities are generally events that require intentional actions in order to achieve value. Risks are events that can be ignored.

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For a detailed discussion of this issue as well as a definitive presentation of risk management, see Appendix E, "Changing the Definition of Risk – Why Risk It?" Robert N. Charette, in *Effective Risk Management: Some Keys to Success*, 2nd Edition, Edmund H. Conrow, American Institute of Aeronautics and Astronautics Press, 2003.

- [2] "Agile Program Management: Moving from Principles to Practice," Glen B. Alleman, Cutter Agile Project Management Advisory Service, Volume 6, Number 9.
- [3] Appendix H: Some Characteristics and Limitations of Ordinal Scales in Risk Analyses, in *Effective Risk Management*, Edmund Conrow, AIAA, 2003.
- [4] Although the use of ordinal values is simple it is fraught with problems. Ordinal are a standard approach to risk ranking. If ordinal scales are used, their values must be derived from the underlying probability data or be calibrated with actual probability data. This is a complex topic best addressed in a book length manner. Appendix H and Appendix J of *Effective Risk Management*, E. H. Conrow are the best sources.
- [5] *Risk Management Guide for DOD Acquisition*, pp. 88.