

Integrating Risk Into Project Scheduling



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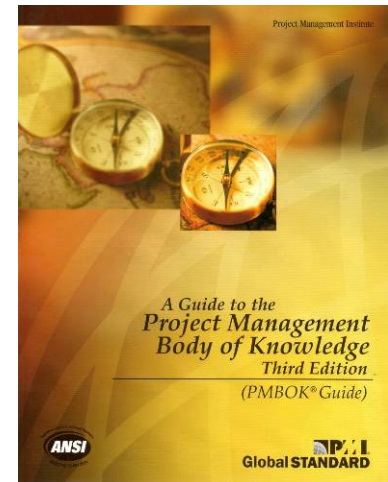
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Why Bother

- We'll Cross That Bridge When We Get There
- That Will Never Happen On This Project
- We'll Fix Them In The Next Version
- We've Always Done It This Way
- Bearers of Bad News Get Punished



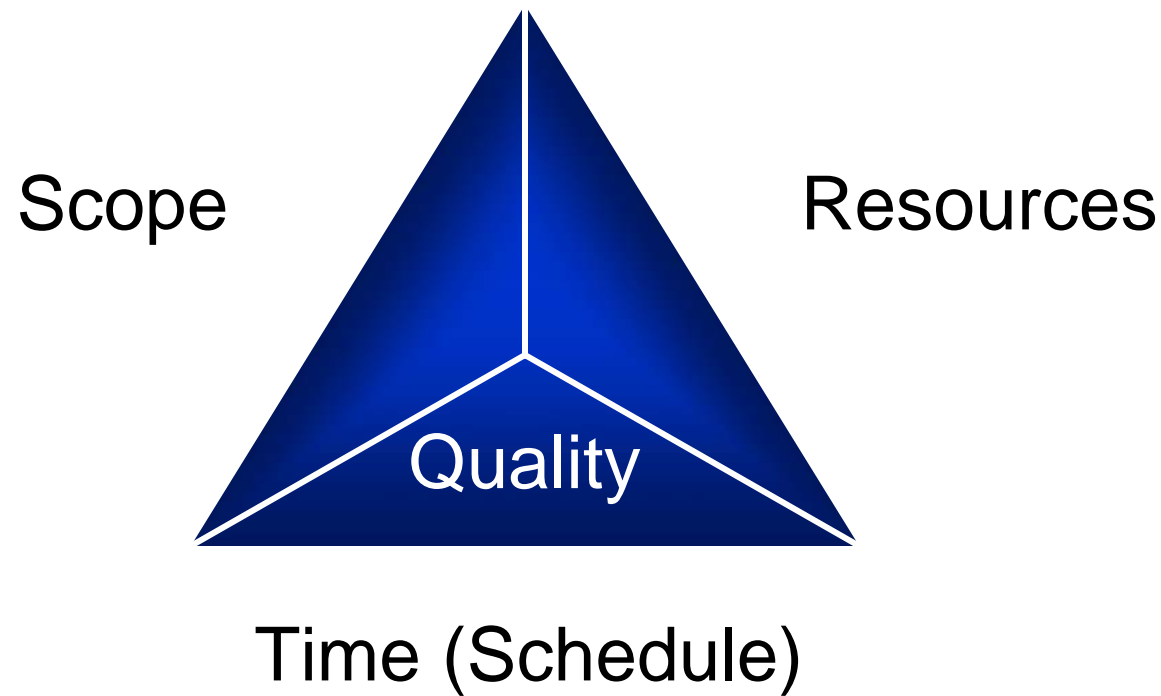
- Project Risk Management
 - PMBOK – Knowledge Area 11
 - “An uncertain event or condition that, if it occurs, has a positive or negative effect on a project’s objective.”



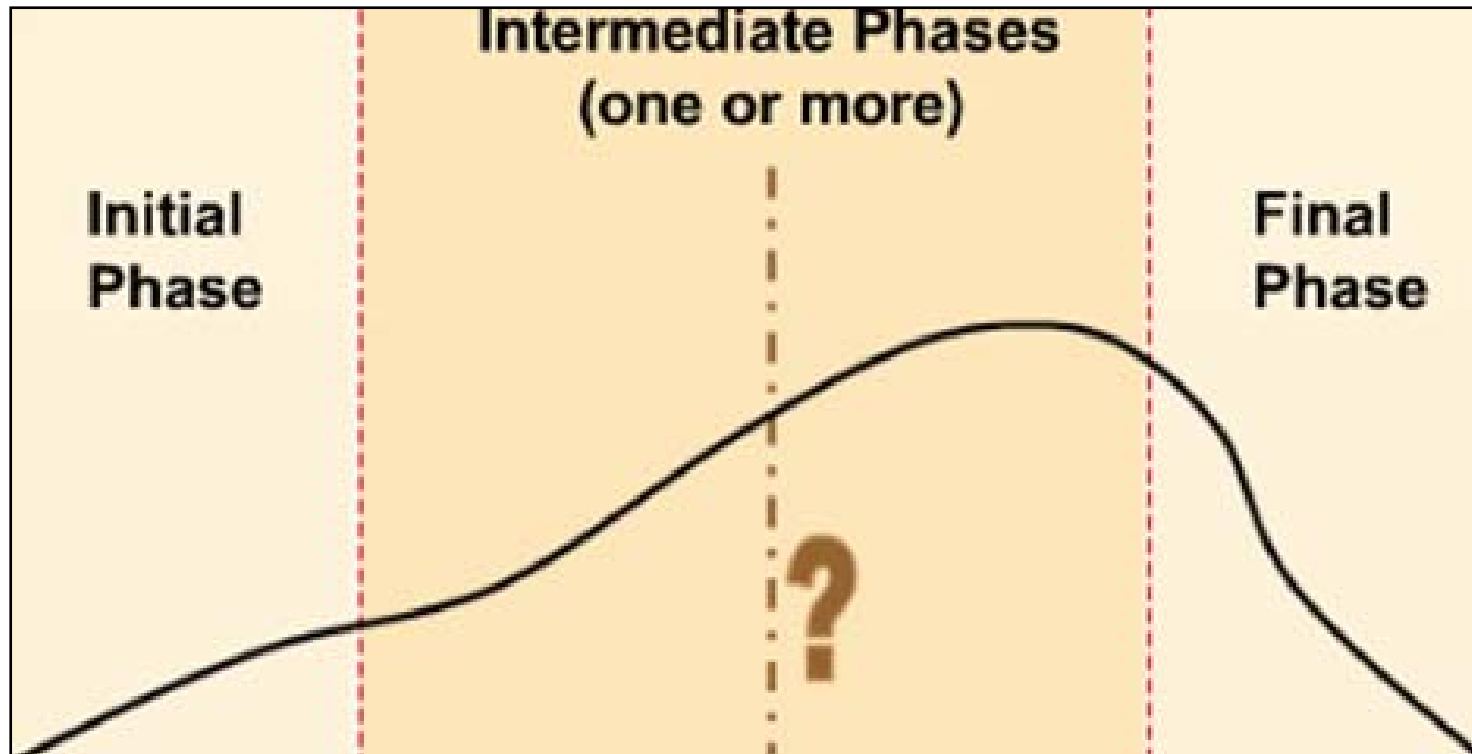
There Are No Facts About The Future

Purpose of Project Risk Management

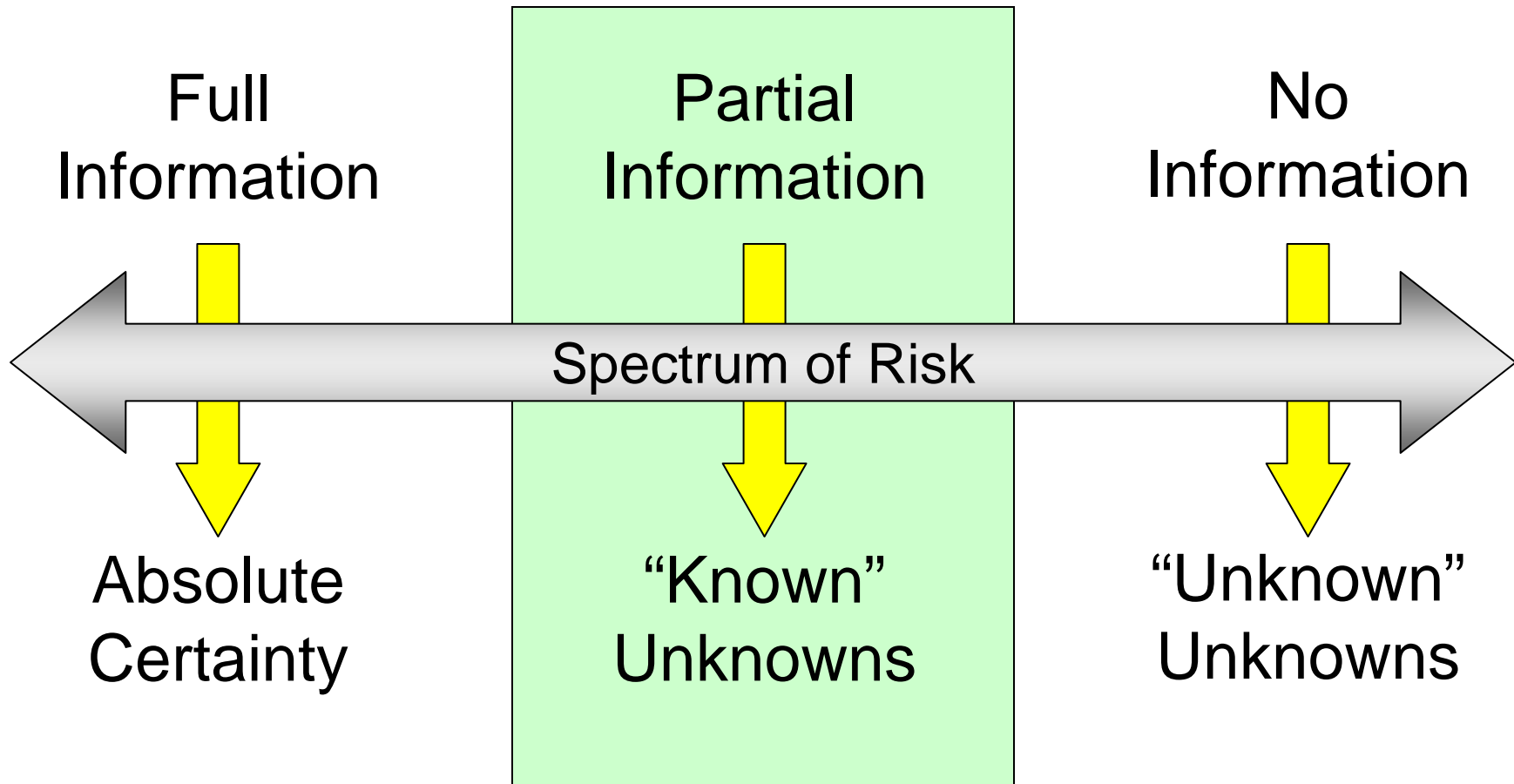
- Identify Factors that are Likely to Impact Project Objectives



When Can Risk Occur



Flavors of Risk



Risk According to Dilbert

DILBERT

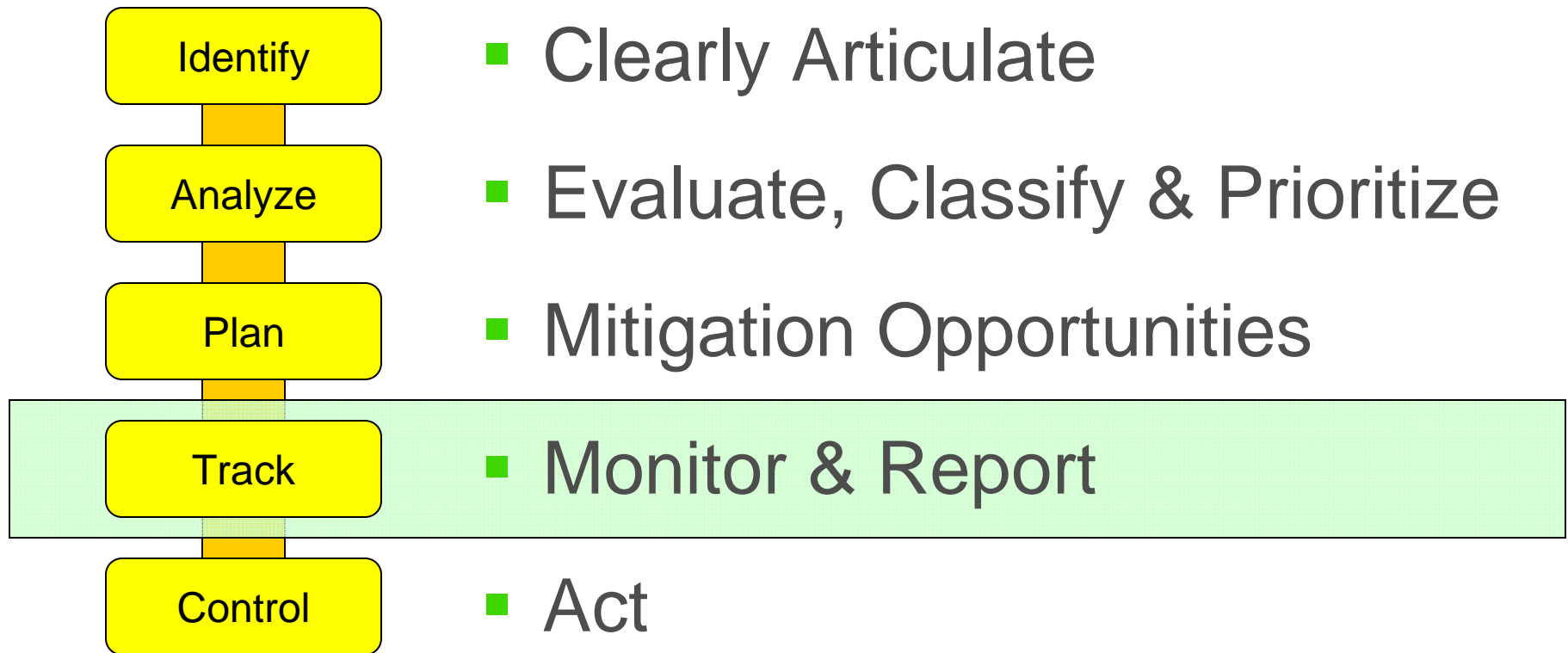


Risk Management Process

- Systematic, Continuous Process
- NASA Procedural Requirements
 - NPR 8000.4 – Risk Management Procedural Requirements



Risk Management Process

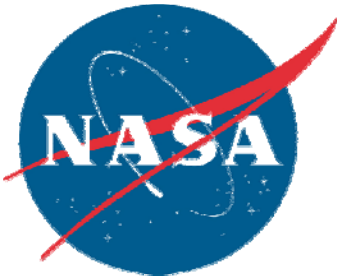


Identify

Risk Management Process

- Risk Statement

- “Given the tile gap filler material is extended above the tiles; there is a possibility that the protrusions might produce excessive heat during re-entry causing catastrophic damage to the vehicle.”



Discovery
STS-114



Identify

Risk Management Process

- Risk Statement

- “**Given the tile gap filler material is extended above the tiles;** there is a possibility that the protrusions might produce excessive heat during re-entry causing catastrophic damage to the vehicle.”

Risk
Condition



Identify

Risk Management Process

- Risk Statement

- “Given the tile gap filler material is extended above the tiles; **there is a possibility that the protrusions might produce excessive heat during re-entry causing catastrophic damage to the vehicle.**”

Risk
Consequence



Analyze

Risk Management Process

- Likelihood of Occurrence
- Consequences of Occurrence
- 5x5 Impact Matrix

Likelihood of Occurrence	Very High (5)	10	16	20	23	25
	High (4)	7	13	18	22	24
	Moderate (3)	4	9	15	19	21
	Low (2)	2	6	11	14	17
	Very Low (1)	1	3	5	8	12
		Very Low (1)	Low (2)	Moderate (3)	High (4)	Very High (5)
		Consequence of Occurrence				

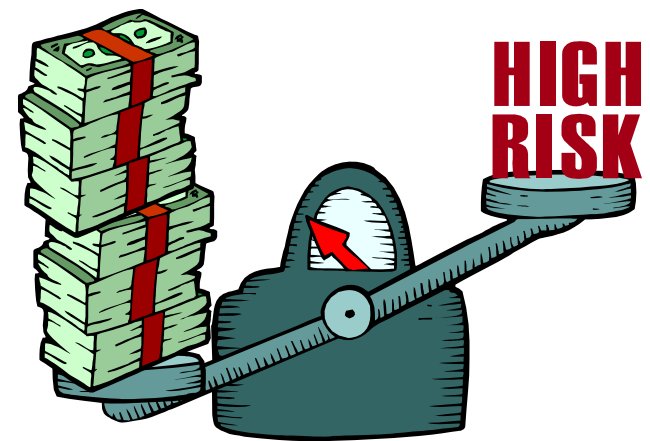
“I think there is a world market for five computers.”

- Thomas Watson, IBM President 1943

Plan

Risk Management Process

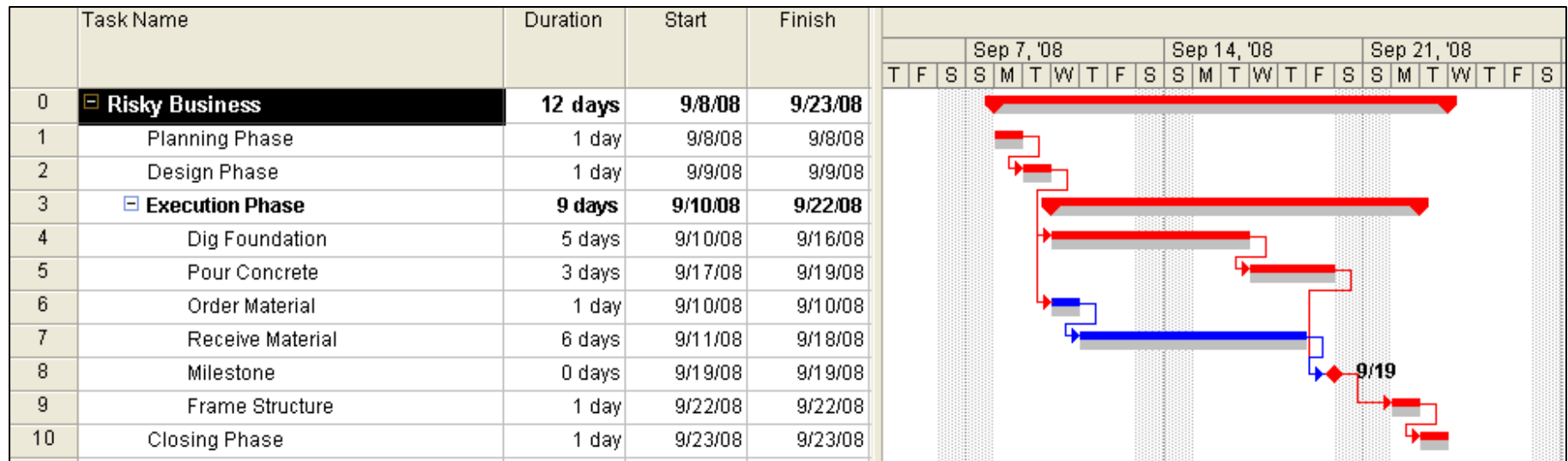
- Do Nothing
 - *Hope is not a Strategy*
- Adjust Expectation
- Develop Mitigation Activities
 - Assess “Impact” of Mitigation
 - “Burn-Down” Risk



Track

Risk Management Process

- Integrate Risk into Project Schedule



Control

Risk Management Process

- Obtain Approval from Risk Board
- Update Risk Registry
- Request Support for Plan
 - Resources: To Support Mitigation
 - Schedule: To Align Delivery
 - Scope: To Communicate Expectations
- Integrate into Cost & Schedule
 - Formal Implementation

Obtaining Credible Estimates

- Overcome Intrinsic Bias
- Methods
 - Expert Judgment
 - Analogous Estimation
 - Parametric Estimation
 - Three-Point Estimation
 - Reserve Analysis



Critical Path Methodologies

Single-Pass

Single-Point
Multi-Point

Based Upon
Probability
Distributions

Multi-Pass

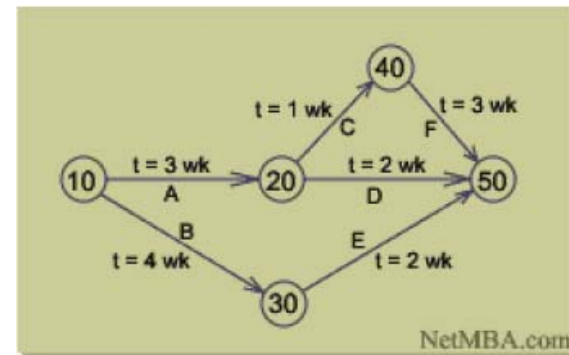
Simulation

Discrete

Continuous

Single-Point Estimation

- Critical Path Method (CPM)
- Developed by DuPont in 1957
- Novel, Yet Simplistic, Approach to Project Network Modeling Requirements
- Based on 'Fixed Estimates' for Task Durations



Multi-Point Estimation

- Program Evaluation & Review Technique
- Developed by Booz-Allen Hamilton in 1958
- Polaris Mobile Submarine-Launched Ballistic Missile Program
 - Special Projects Office Contract with US Navy
- Acknowledges ‘Randomness’ Surrounding Task Duration Estimation

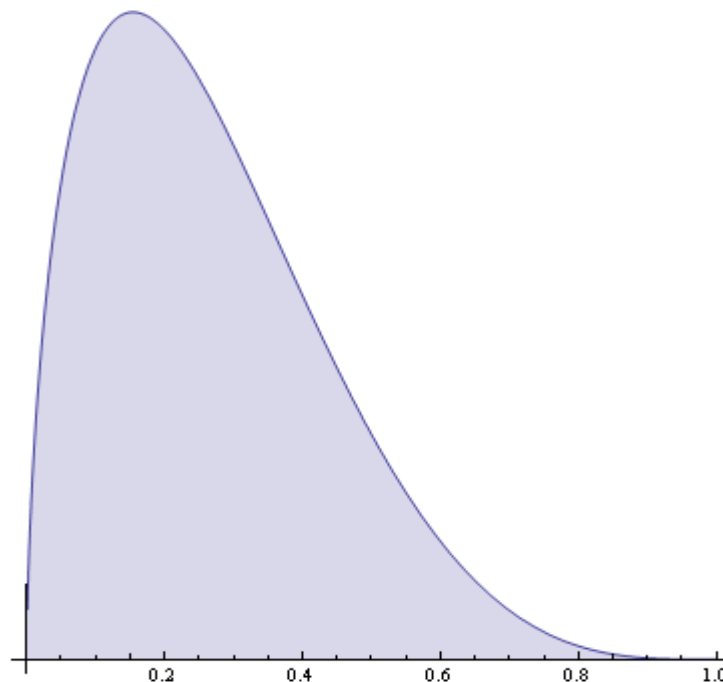
- Studied Bias and Reliability of Task Duration Estimates Collected by Variety of Methods
- Correlated Estimates with Actual Durations and 'Curve-fit' Results to Beta Distribution
- Closed-form First-Order Estimate

$$Expected = \frac{(Optimistic + 4 * MostLikely + Pessimistic)}{6}$$

Beta Distribution & PERT 3-Point Estimate

- Shape Parameters: $\alpha > 0$ and $\beta > 0$
- Unimodal when $\alpha > 1$ and $\beta > 1$
- When $\alpha = 3 - \text{Sqrt}(2)$, $\beta = 3 + \text{Sqrt}(2)$

$\alpha = 1.62$ | $\beta = 4.40$

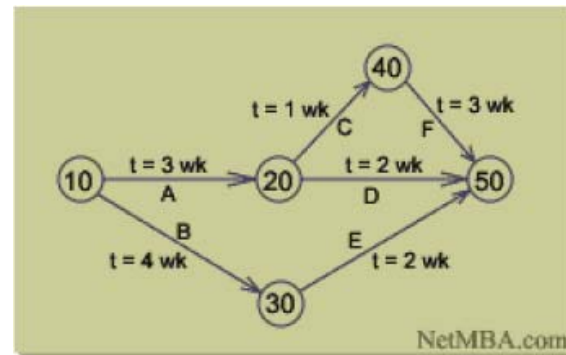


Limitations of PERT

- Naïve Task Durations Assumptions
 - Independent & Uniformly Biased
- Does Not Account For Quality of Estimates
 - Expert, Analogous, Parametric
- Assumes Underlying Probability Distribution Of Estimates Can Be Represented By Beta
- Deterministic Single Pass Calculation

Multi-Pass/Continuous Evaluation

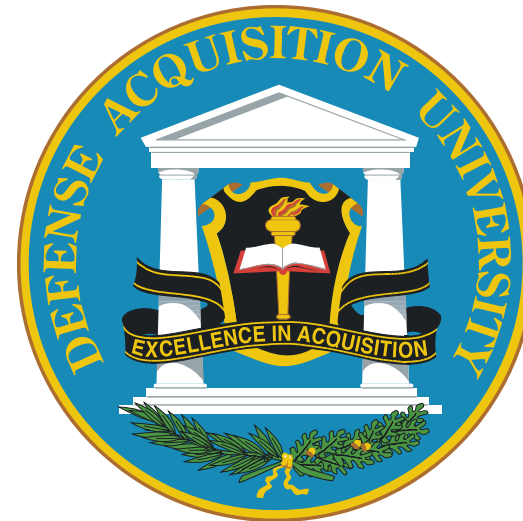
- Reveals Effects of Near-Critical Tasks
- Probabilistic Estimation of Task Durations
- Monte Carlo Simulation
 - Randomly choose from probability distribution
 - Used during Manhattan Project in early 1940s
 - Appropriate When There Is Significant Uncertainty





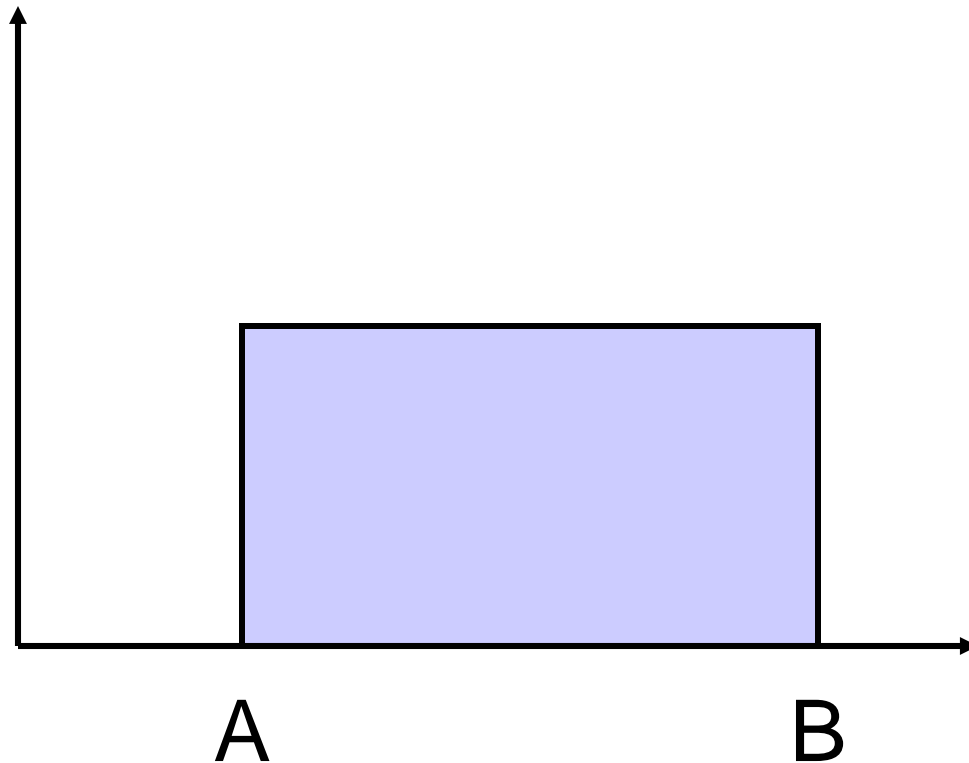
Defense Acquisition University

- Monte Carlo simulation is a statistical technique by which a quantity is calculated repeatedly, using randomly selected 'what-if' scenarios for each calculation



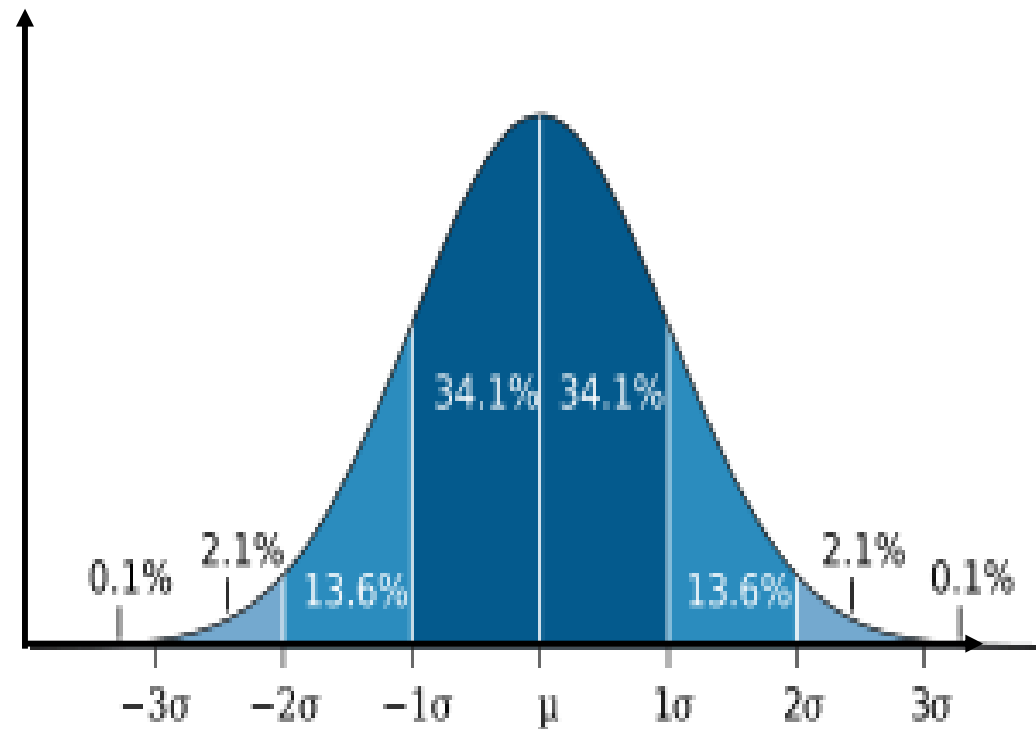
Uniform Probability Distribution

- All Choices are Equally Likely
- May Lack Enough Information To Estimate



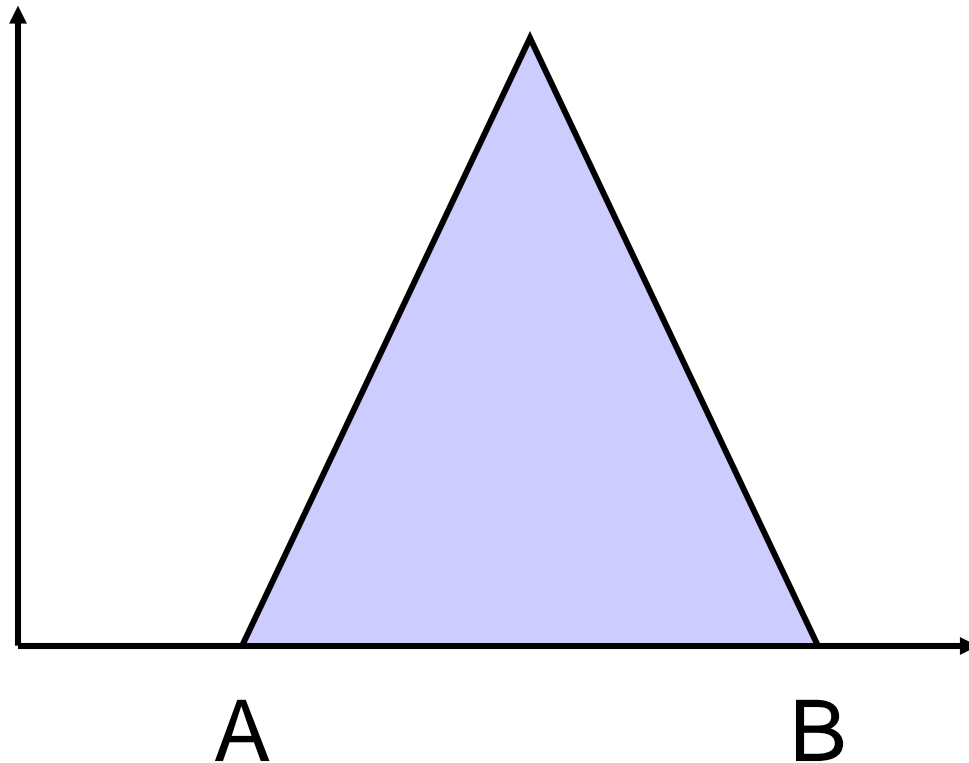
Normal Probability Distributions

- Natural First Step
- Estimates are Centered



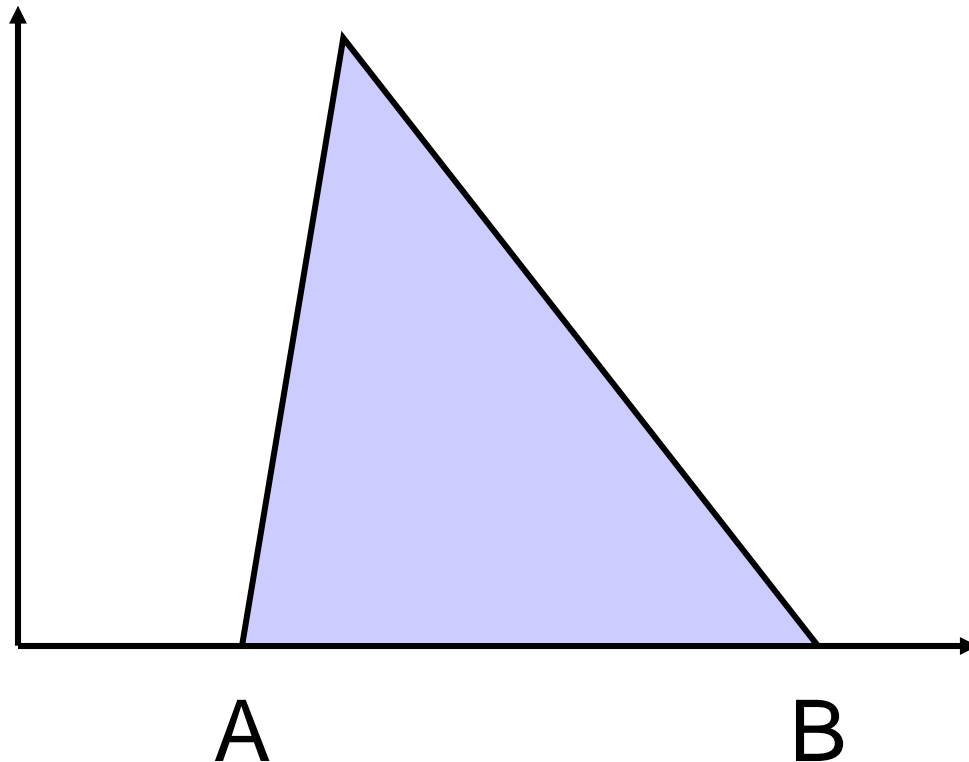
Triangular Probability Distributions

- Baseline Distribution
- Less Confident Than Normal



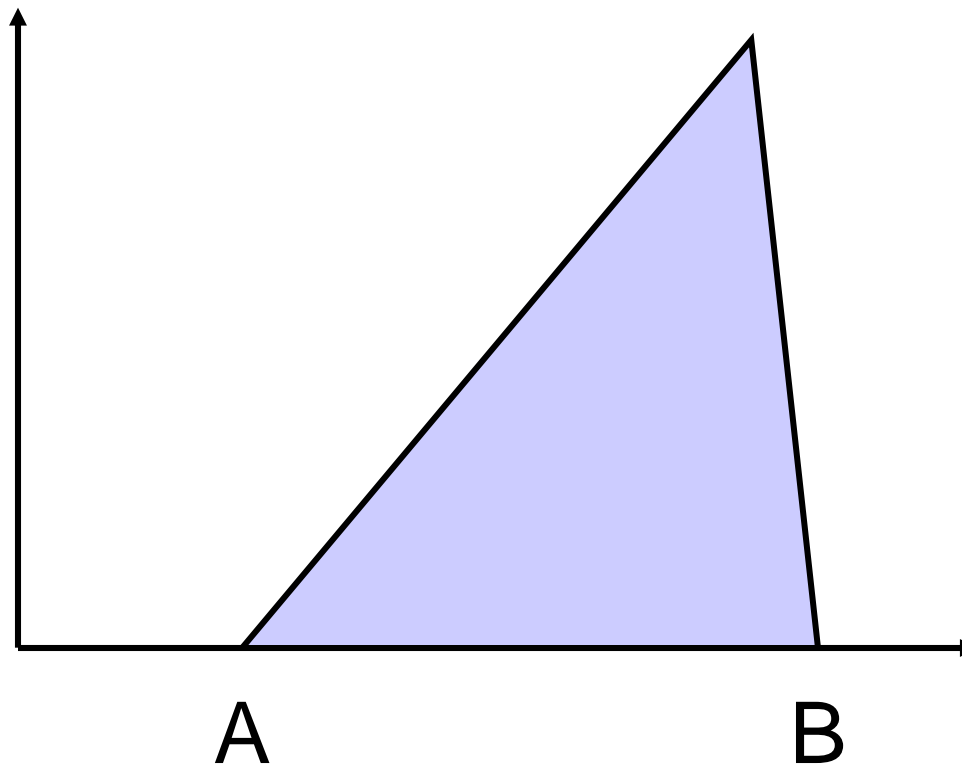
Triangular Probability Distributions

- Can Be Skewed To Incorporate Asymmetric Estimates
- Type 1 Estimator



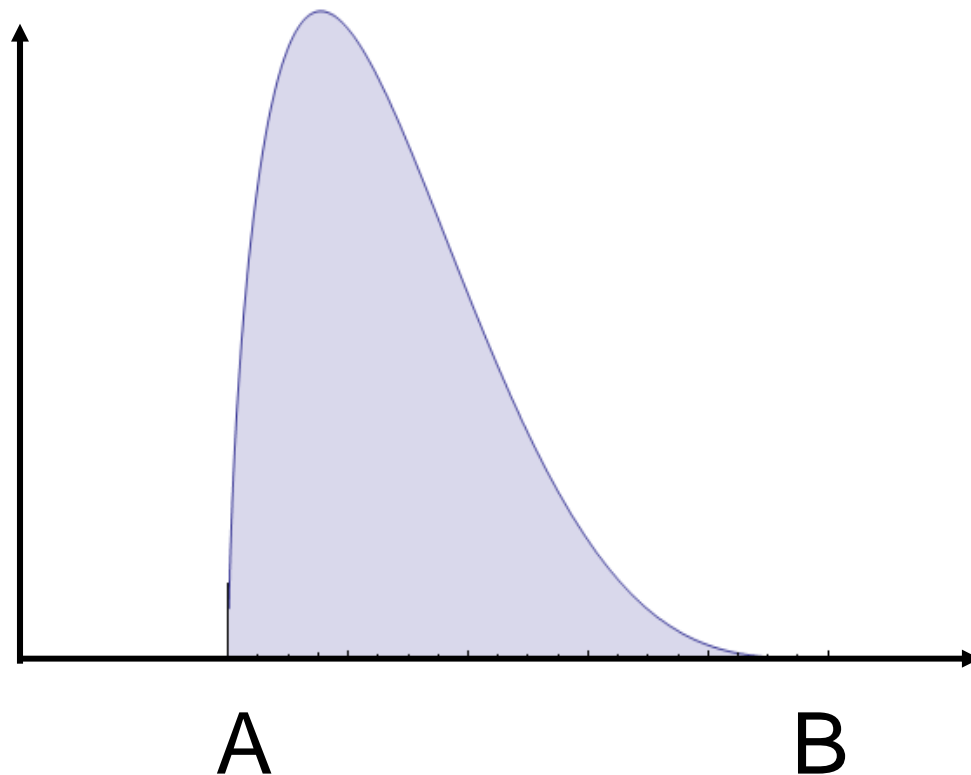
Triangular Probability Distributions

- Can Be Skewed To Incorporate Asymmetric Estimates
- Type 2 Estimator



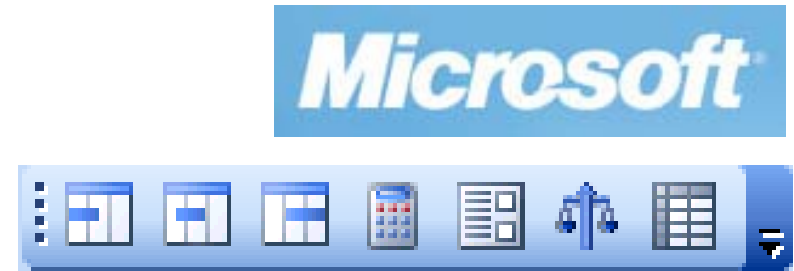
Beta Probability Distributions

- Smaller Standard Deviation Than Normal
- Implies Higher Confidence in Estimate



Native / Add-in Solutions

- Native to MS Project
 - Single-Point Estimation
 - 3-Point Estimation



- Add-in Capability
 - @Risk by Palisade
 - \$795 – Standard Version
 - Full Function 15-day Free Trial
 - Risk+ by Deltek
 - \$695



Risky Business Demonstration

	Task Name	Duration	Start	Finish	Sep 7, '08							Sep 14, '08							Sep 21, '08													
					T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S				
0	Risky Business	12 days	9/8/08	9/23/08																												
1	Planning Phase	1 day	9/8/08	9/8/08																												
2	Design Phase	1 day	9/9/08	9/9/08																												
3	Execution Phase	9 days	9/10/08	9/22/08																												
4	Dig Foundation	5 days	9/10/08	9/16/08																												
5	Pour Concrete	3 days	9/17/08	9/19/08																												
6	Order Material	1 day	9/10/08	9/10/08																												
7	Receive Material	6 days	9/11/08	9/18/08																												
8	Milestone	0 days	9/19/08	9/19/08																												
9	Frame Structure	1 day	9/22/08	9/22/08																												
10	Closing Phase	1 day	9/23/08	9/23/08																												

- Well Formed Network
 - No Hard Constraints
 - Predecessors / Successors Defined
 - 80%+ Are Finish-to-Start

Risk+ Analysis Process Steps

1. Develop Well Formed Project Plan
2. Enter Risk Parameters
3. Identify Reporting Tasks
4. Run Simulation
5. Analyze Outputs
6. ... Repeat

Let's Demonstrate

Key Takeaways

- Existence of Risk is a Certainty
- Risk Impacts Triple Constraint Objectives
- Continuous Risk Management
- Work the Process & Report Results
- Record Actions & Outcomes
- Probabilistic Simulation of Project Network is Meaningful and Do-able



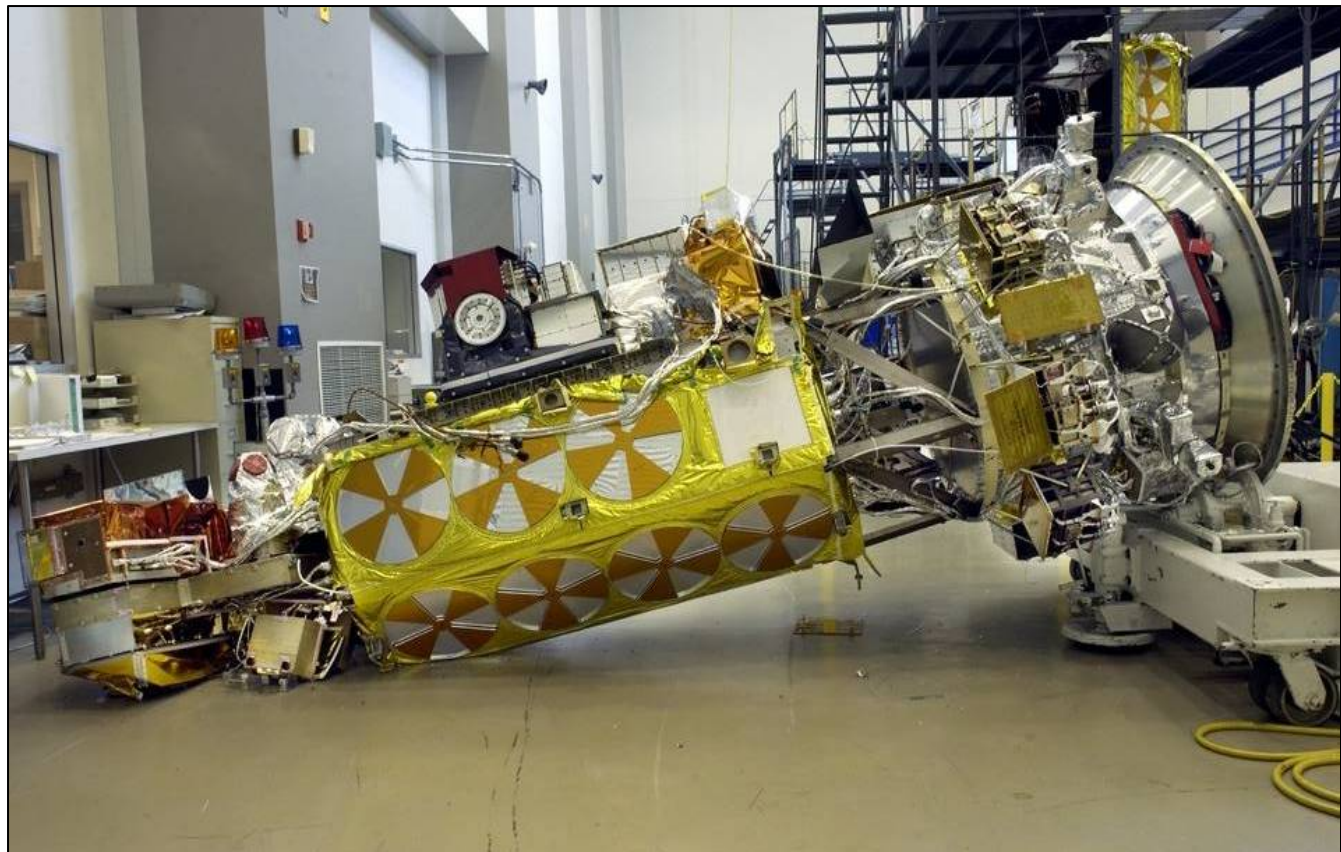
For More About Risk+

- Deltek
 - <http://www.deltek.com>
- Seamless Integration with MS Project
- Cost & Schedule Risk Histograms
- Add Custom Probability Distributions
- Probability Branching
- VBA Hooks



Failure to Communicate

- Modifications Made Without Documentation



Questions

- Thank you for attending
- Presentation slides will be posted to the Member Area of the MPUG site archive

