

# ***Risk Management Metrics***

**International Council on  
Systems Engineering  
Risk Management Working Group  
Mark Powell, Chair**

# ***Proper Attribution***

- **A project in work by the INCOSE RMWG**
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- **Originally Presented at INCOSE International Symposium July 2005 in Rochester, NY**
- **Presenter: Mark Powell, RMWG Chair**

# ***The Problem with Risk Management***

- **A good risk management process results in nothing happening**
- **How does one measure process performance?**
- **Multiple choice:**
  - **If a project meets its performance goals, then ...**
    - **A. It's risk management process was successful**
    - **B. The project had a run of good luck**
    - **C. The project was under-constrained**
    - **D. All of the above**
  - **If a project overruns its cost commitments, then ...**
    - **A. Its risk management process failed**
    - **B. The project got a bad roll of the dice**
    - **C. The project was over constrained**
    - **D. All of the above**

# ***Risk Management Measurements?***

- **What do you measure?**
- **How do you measure it?**
- **How do we know what is a “good” measurement, or a “bad” measurement?**
- **INCOSE Chartered RMWG to Investigate RM Metrics**

# ***Potential RM Metrics***

- **Comparison Metrics**
  - Other standards
  - Using CMMs
  - Problem: Assumes that the others are “good”
- **Return on investment Metrics**
  - Cost of investment of risk management process execution ratio-ed to the reduction of risk
  - Estimate the risk without a mitigation plan, then ratio to estimated risk after planned mitigation, compare to
  - Problem: both are estimates, inadequate historical basis
- **Efficiency and Effectiveness Metrics**
  - Measure attributes of the process that indicate efficiency and effectiveness
  - Problem: Has promise, but very limited experience

# ***Potential Metrics Continued***

- **Staleness Metrics**
  - **Measure the lag in the flow of products through the risk management process – too long in one step of the process is “bad”**
  - **Problem: Not specific to the quality of the process -- will also measure the lag in a bad process**
- **Trending Metrics**
  - **Measure the change in the number of risks in various categories over time**
  - **Problem: Assumes that all risks are equal – one “very bad” risk may overwhelm many other “bad” risks and give a false sense of security**

# ***Potential Metrics Concluded***

- **Results of RMWG Investigation**
  - **The best measure – actually compare estimates to outcomes**
  - **Problem: Statistical in nature and requires sampling and analyses of many cases to develop models and relationships**



**So, what to do? A proposal follows.**

# ***RMWG RM Metrics Proposal***

- **RM Metrics Classified by Usage Frequency**
  - **Infrequent Metrics**
    - Usually before or after a project
    - When significant performance issues are noted
    - During the development of a Risk Management process
  - **Continuous Metrics**
    - Measure the process during execution
    - Measure the quality of the products during execution
    - Attempt to make interim corrections if needed
  - **On-demand Metrics**
    - When a measurable result is available, compare to expectations
    - Ad Hoc or Periodic



# Infrequent Metrics and Measurements

- **Compliance to organization’s standards**
  - **Build a compliance matrix – extract “Shall” statements**
  - **Compare project’s process against the organization's standards**

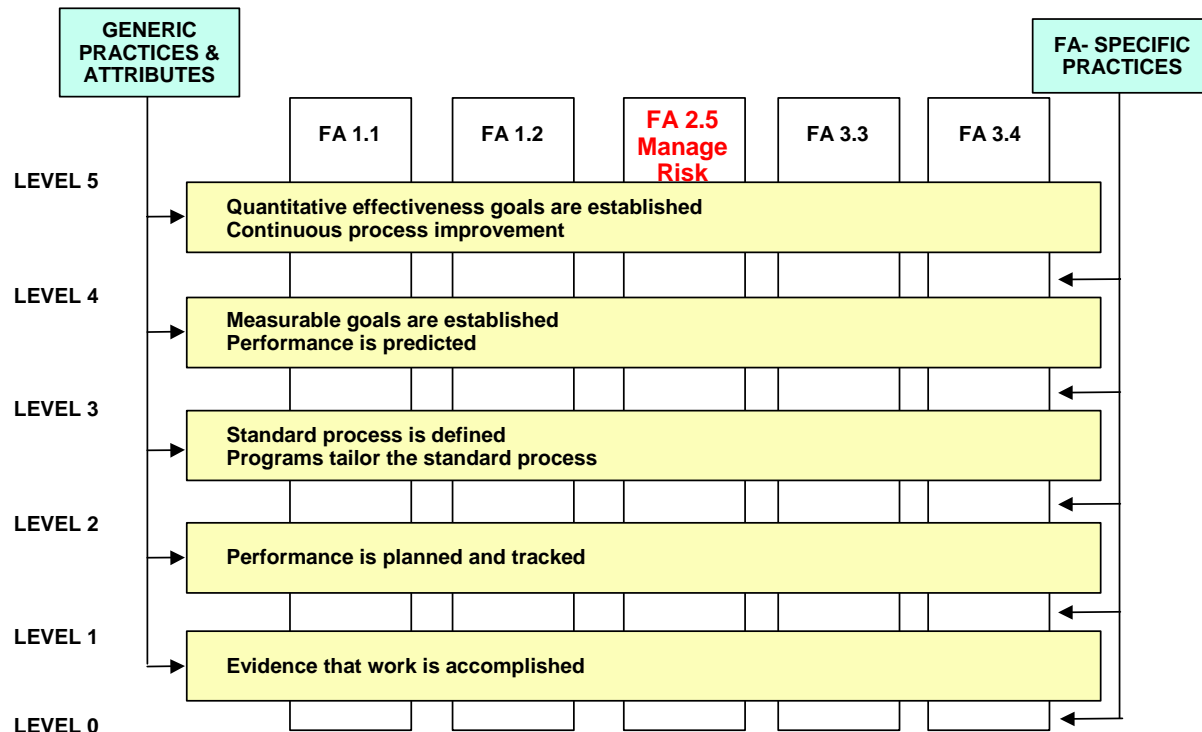
Project Compliant?	“Shall” Statement	Project RM Plan Paragraph
5	The identification of risk shall be actively encouraged at all levels in the Project Team	Pg. 2, Section 1.6
4	Risk identification shall be accomplished by entering the information into the Kepler Risk Database through the Kepler Risk Tracking Tool.	Pg. 2, Section 1.6
	Identified risks shall be reviewed by Project Management on a cyclical basis and accepted, assigned to a manager for action, rejected or retired.	Pg. 2, Section 1.6

A scale of 1 to 5 indicating level of compliance

Corrective Action?

# Infrequent Metrics and Measurements

- Compliance to “Best Practices”
- No consensus on what are “Best Practices”
- Use CMMs as a substitute



# Sample CMM Assessment

The CMM Questionnaire Assessment Tool showed projects interviewed as Level 2 or less

Management Category		Level 1 Specific Practices are performed	Results are at least of marginal utility	Level 2 Specific Practices are performed	Level 2 Generic Practices are performed	Results are at least of adequate utility	Level 3 Specific Practices are performed	Level 3 Generic Practices performed	Results are of at least significant utility	Level 4 Specific Practices are performed	Level 4 Generic Practices performed	Results are at least of measurably significant utility	Level 5 Specific Practices are performed	Level 5 Generic Practices performed	Results are of optimum utility	Capability Maturity Level BY Assessment Tool
Project 01A																0
Project 01B																2
Project 02																2
Project 03																2
Project 04																2
Project 05																1
Project 06																2
Project 07																2
Project 08																2
		Level 1		Level 2			Level 3			Level 4			Level 5			

# ***Continuous Metrics***

- **Compliance to Plan**
- **Performance**
  - **Effectiveness**
  - **Efficiency**
  - **Staleness**
- **Trending**

# ***Continuous Metrics: Compliance to Plan***

- **Compliance to RM Plan**
  - **Is the project actually doing what it said it would do?**
  - **A simple compliance matrix**
  - **Shall statements from the RM Plan for the project versus evidence that the activities are actually performed**
  - **Determine corrective action**

# ***Continuous Metrics: Performance***

- **Performance – measure the performance of the process**
  - **Effectiveness**
    - **Effective:** No or very few unforeseen “problems” occur
    - **Approach:** How many “problems” occurred that were never identified as risks
  - **Efficiency**
    - **Efficient:** Catching risks early when it is more cost effective to mitigate them
    - **Approach:** Measure the time between when a risk was identified and when it became a problem
  - **Staleness**
    - **How many risk products are “stuck” in a process step and how long have they been there**

# ***The Effectiveness Metric***

- **Performance – Effectiveness**
  - **Premise: An effective risk management system will prevent unexpected problems**
  - **$P_E$ , Process Effectiveness is the ratio of problems encountered,  $N_p$ , that were not identified as risks, to the risks identified,  $N_r$**   
$$P_E = 1 - N_p / (N_p + N_r)$$
  - **Measure of goodness, 90% good, 80% watch, 70% Action**
  - **Action, causal analysis and process improvement**

# ***The Efficiency Metric***

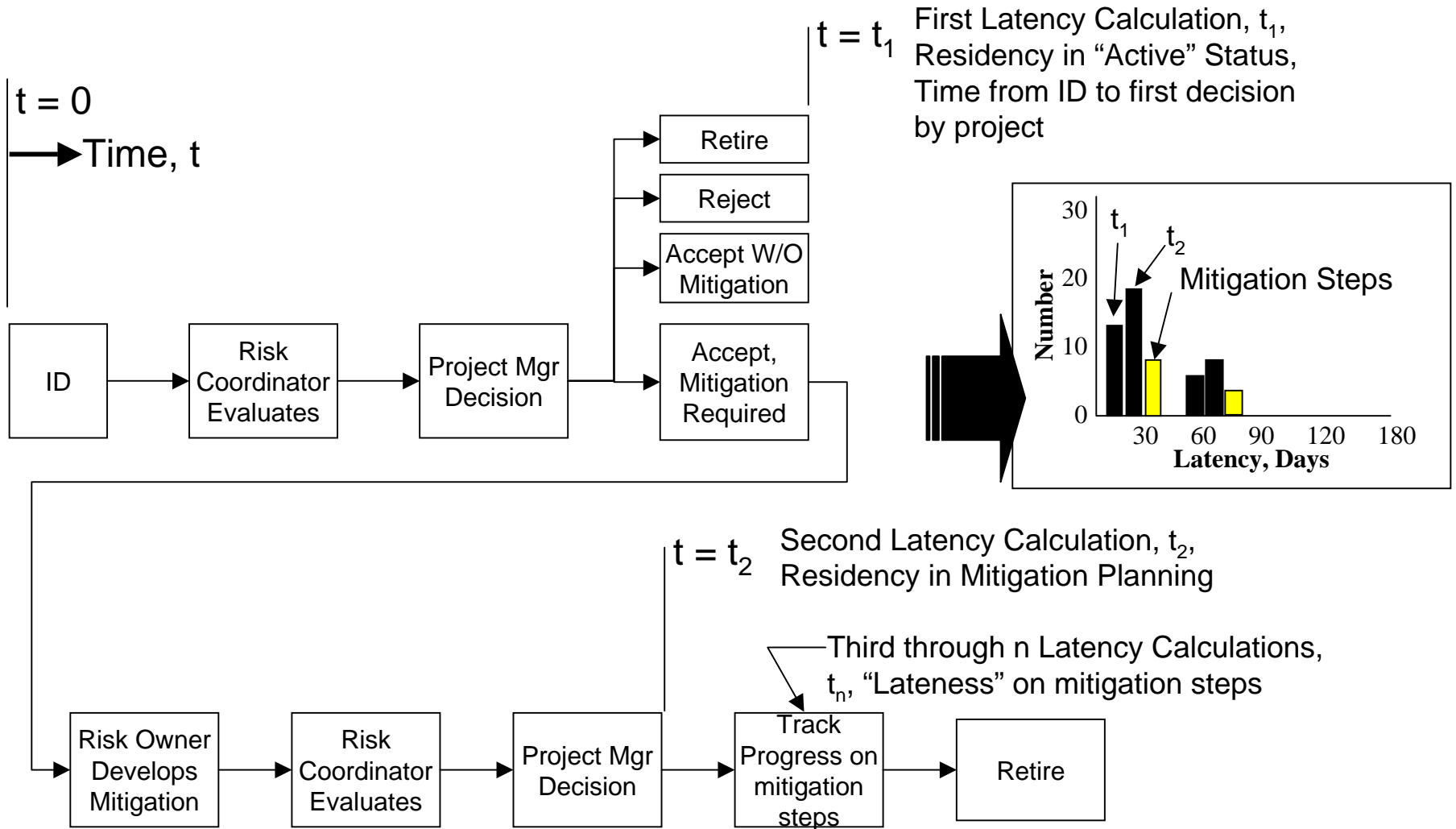
- **Performance – Efficiency**
  - **Premise: An efficient risk management system is one in which the planning and mitigation of risks occurs well before they become problems**
  - **For n realized risks,  $P_e$ , Process efficiency, is the average time lapse between all risks' identification date,  $T_{ID}$ , and the time that it is realized,  $T_R$ ,**
    - **$P_e = \sum_{i=1,n} (T_{R,i} - T_{ID,i})/n$ ,**
  - **Measure of goodness, 90% good, 80% watch, 70% Action**
  - **Action, causal analysis and process improvement**



# *The Staleness Metric*

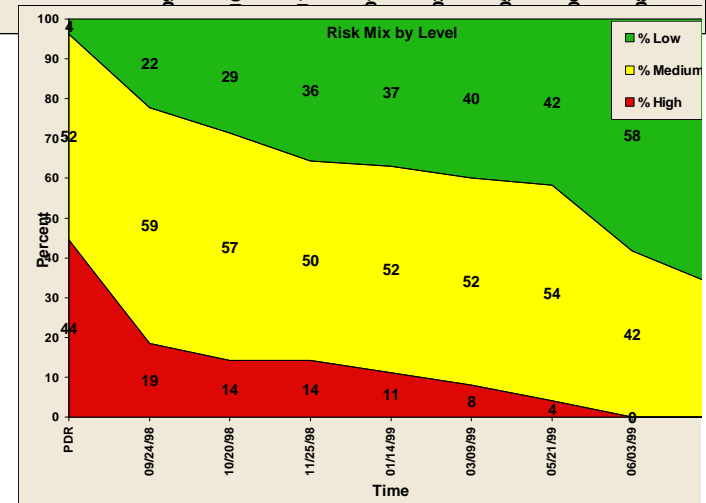
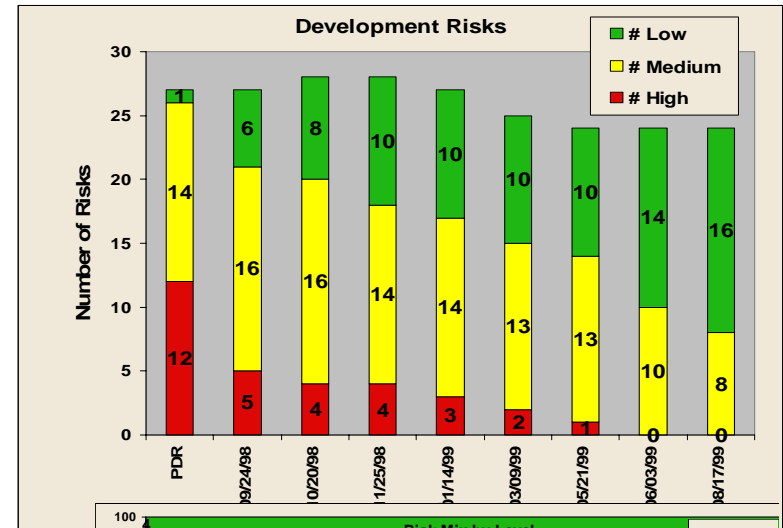
- **Performance – Staleness**
  - Residence time for risks in major steps
  - Short residence times: < ~30 days, are “Excellent”  
long residence times: ~180 are “Very Poor”
  - Measure of goodness: 90% good, 80% watch, 70% Action
  - Action: directed project management attention to insure actions
- **Example measures:**
  - *First Latency*: Time identified to time first action by project management
  - *Second Latency*: Time from assignment to a Risk Owner to time the project “Accepts” the risk mitigation plan
  - *Subsequent Latencies*: Lateness tracked against dates on the steps in the risk mitigation plan

# Sample Latency Measurement



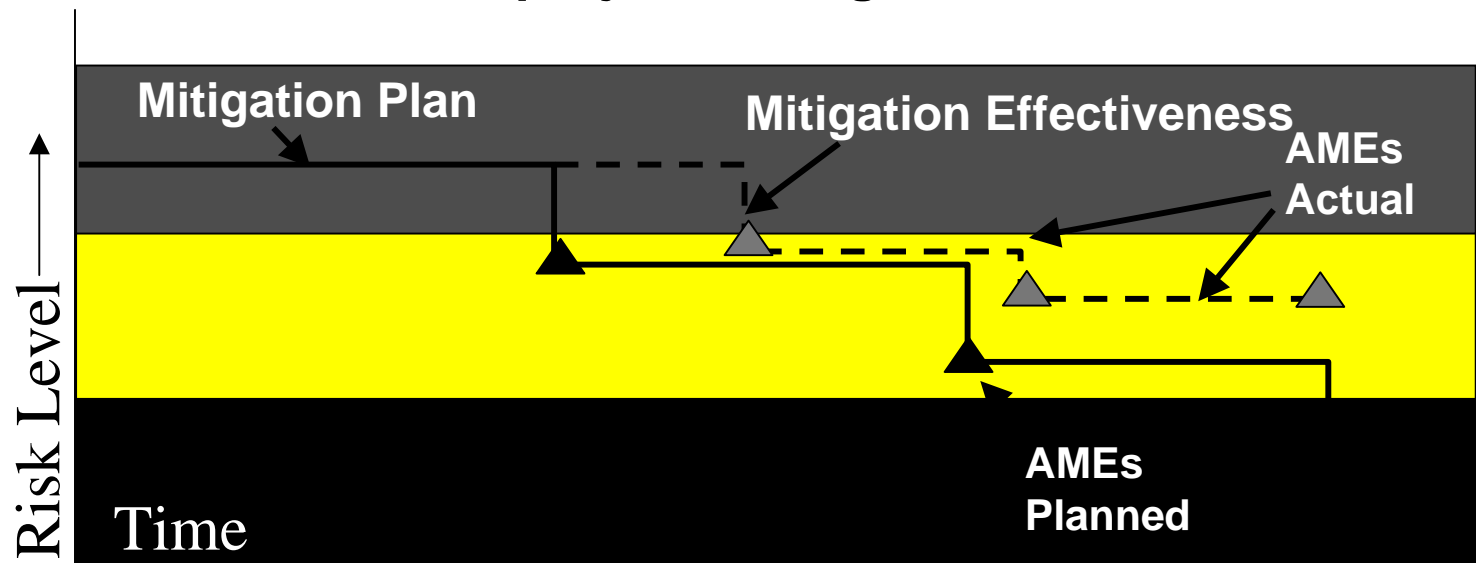
# Trending Metrics

- **Body Count versus time**
- **Measure change**
- **Goodness is more vague on this one**
  - No change is “bad”
  - Increasing risk numbers may be “bad”
  - A decreasing trend in the red and yellow is good
- **Action, directed project management attention to insure actions**



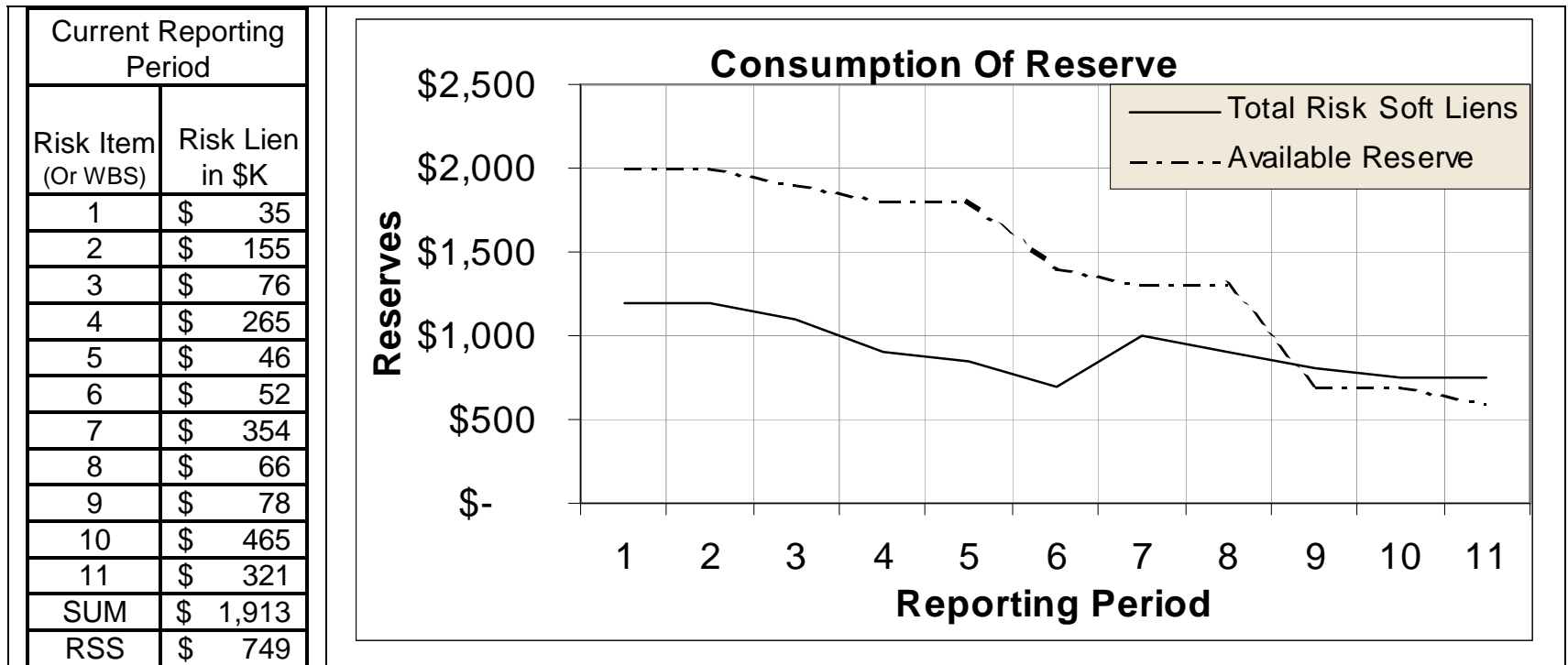
# More Trending Metrics

- Waterfall charts
- Measure
  - Latency (Calculated elsewhere)
  - Errors in prediction of impact or effectiveness of mitigation
- Goodness: Miss residual risk by “half a color”
- Action: directed project management attention to correct



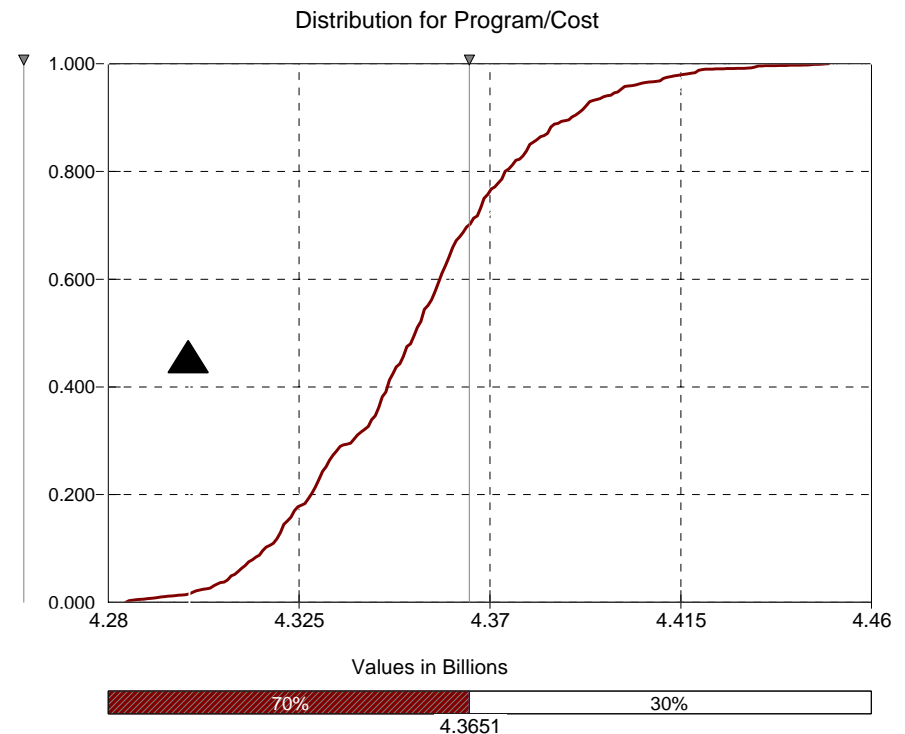
# Example: Consumption of Reserve

- Comparison of Expected Value of risks to available reserve



# On-Demand Metrics: Results

- Based on risks that have been accepted by the project either with or without mitigation
- Should those risks be realized, the impact is measured
- Compare the measured impact with the predicted impact
- Action, causal analysis and process improvement



# ***Summary of Metrics***

- **Infrequent**
  - Measure the quality of the process
  - Compliance to the organization's standards
  - Comparison with Best Practices
- **Continuous**
  - Compliance to plan
  - Performance
    - Effectiveness
    - Efficiency
    - Staleness
  - Trending
- **On-demand**
  - Results - for “accepted” risks that are realized, compare actual risk outcomes with predictions.

# ***INCOSE RMWG Recommendation***

- **A Proper Combination of Metrics should be Selected**
  - **Individual Metrics are Not Sufficient**
  - **Should Include Each Frequency Type**
- **RM Process Performance is Measurable and Hence Manageable**
- **RM Process Performance Can be Justified**