

Introducing a Dynamic Schedule Risk Rating Methodology

2022 NASA Cost & Schedule Symposium

13 May 2022

Dewey E. Barlow, Faith Kahler, Ryan Smith and Andrew Soukup

Dewey.barlow@jhuapl.edu, Faith.kahler@jhuapl.edu, Ryan.smith@jhuapl.edu, Andy.Soukup@jhuapl.edu

Agenda

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- Schedule Risk Rating
 - Definition
 - Schedule Risk Rating in Practice
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*Parker Solar Probe (PSP) launch in August 2018 with the mission of making observations of the outer corona of the Sun.

Current Risk Rating/Matrix

Likelihood of Occurrence	5-Very High			X		
	4-High					
	3-Medium					
	2-Low					
	1-Very Low					
		1 Minimal	2 Moderate	3 Significant	4 Major	5 Unacceptable
		Consequence of Occurrence				

S3001: Guidelines for Risk Management

		CONSEQUENCE				
		1	2	3	4	5
Performance		Minimal consequence to objectives/goals	Minor consequence to objectives/goals	Unable to achieve a particular objective/goal, but remaining objective goals represent better than minimum success or outcome	Unable to achieve multiple objectives/goals but minimum success can still be achieved or claimed	Unable to achieve objectives/goals such that minimum success cannot be achieved or claimed
Safety	Human	Discomfort or nuisance	First aid event per OSHA criteria	No lost time injury or illness per OSHA criteria	Lost time injury or illness per OSHA criteria	Loss of life
	Asset	Minimal consequence: asset has no sign of physical damage	Minor consequence: asset has cosmetic damage and is repairable	Minor consequence: asset is damaged but repairable	Major consequence: asset is substantially damaged but repairable	Destroyed: asset is compromised, and un-repairable: a total loss
Schedule		Minimal consequence	Critical path is not slipped; total slack of slipped tasks will not impact critical path in less than 10 days	Critical path is not slipped; total slack of slipped tasks is within 10 days of impacting the critical path	Critical path slips	Critical path slips and one or more critical milestones or events cannot be met
Cost		Minimal consequence	Minor cost consequence. Cost variance ≤ 5% of total approved FY baseline	Cost consequence. Cost variance >5% but ≤ 10% of total approved FY baseline	Cost consequence. Cost variance >10% but ≤ 15% of total approved FY baseline	Major cost consequence. Cost variance >15% of total approved FY baseline

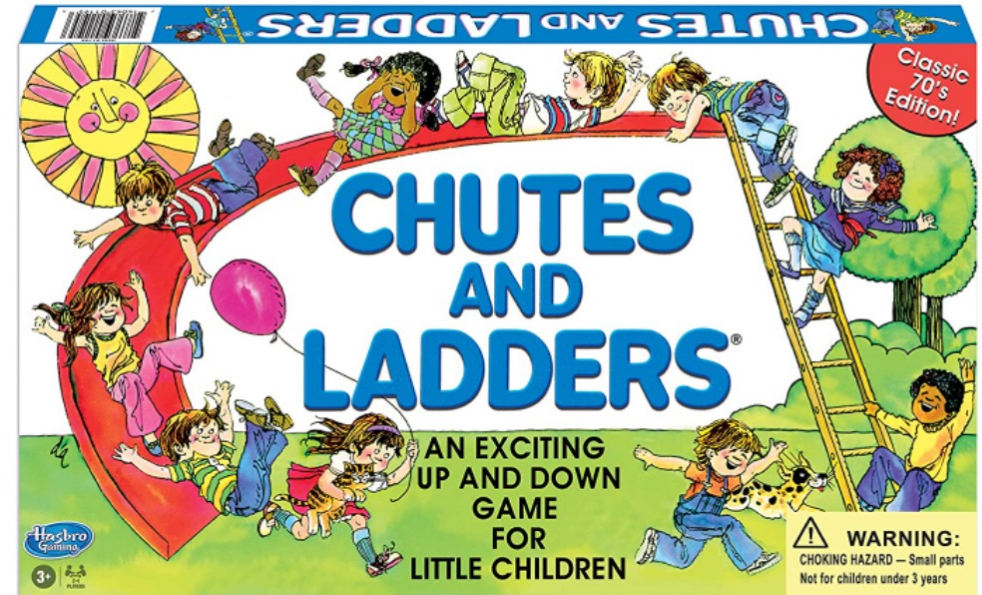
https://www.nasa.gov/sites/default/files/atoms/files/s3001_guidelines_for_risk_management_-_ver_g_-_10-25-2017.pdf

This presentation focuses on Schedule risk, but the concept can be applied to other categories of risk, as well

Audience Poll:

➤ Who has ever played Chutes and Ladders?

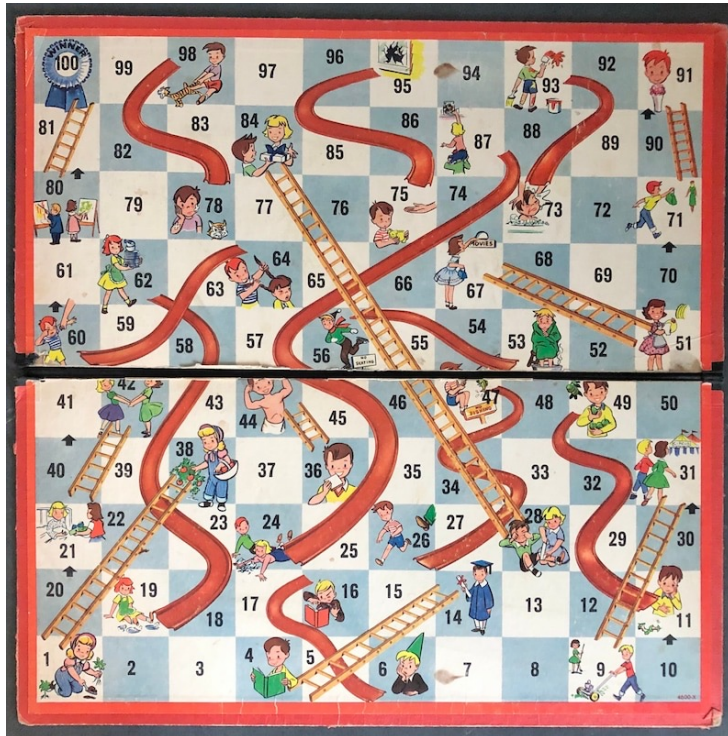
Yes	No
Dewey Barlow	Ryan Smith
Faith Kahler	
Andy Soukup	



Schedule Risk

Definition:

An uncertain event or condition, that if it occurs, has a positive or negative effect on a project's objective (PMBOK®)



1956 Vintage Chutes & Ladders Game Board

Chutes and Ladders - Classic Board Game

How to Play – Each player spins the dial and advances their game piece the # of spaces spun

Objective – First player to make it to 100 wins

Ladder – If a player lands on a ladder they advance their game piece to the top of the ladder (Positive effect on schedule risk)

Chute – If a player lands on a chute they retreat their game piece to the bottom of the chute (Negative effect on schedule risk)

Schedule risk (chute or ladder) and uncertainty (spinner) are aptly demonstrated in this game

Schedule Risk Matrix

- Risk Matrix: “A graphical representation of the likelihood and consequence scores of a risk. The rows of a Risk Matrix show likelihood scores, while the columns show the consequence scores.” (NPR 3001)



Schedule Risk **Likelihood** (the probability that it will be actualized) is analogous to spinning the dial on the spinner, but instead of a random outcome, the **outcome is predicated upon the estimated probability** that the risk will be actualized



Schedule Risk **Consequence** (the outcome of a risk that may lead to degraded performance) is analogous **estimating the height of the chute or ladder**

Schedule Risk

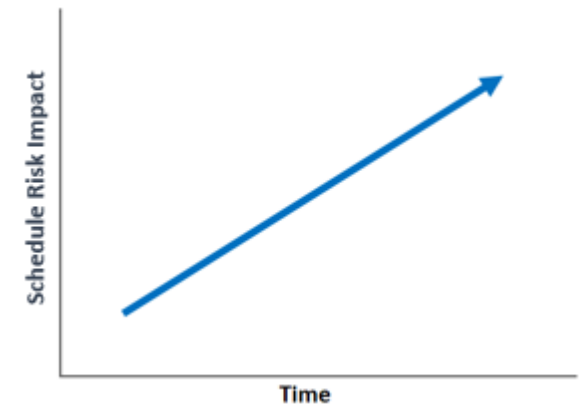
Schedule Risk in Practice

Due to technical complexity, the Chutes and Ladders parallel for NASA is dominated by chutes (with very few ladders), and the **severity of the chute (negative schedule impact) increases as we progress towards project completion.**



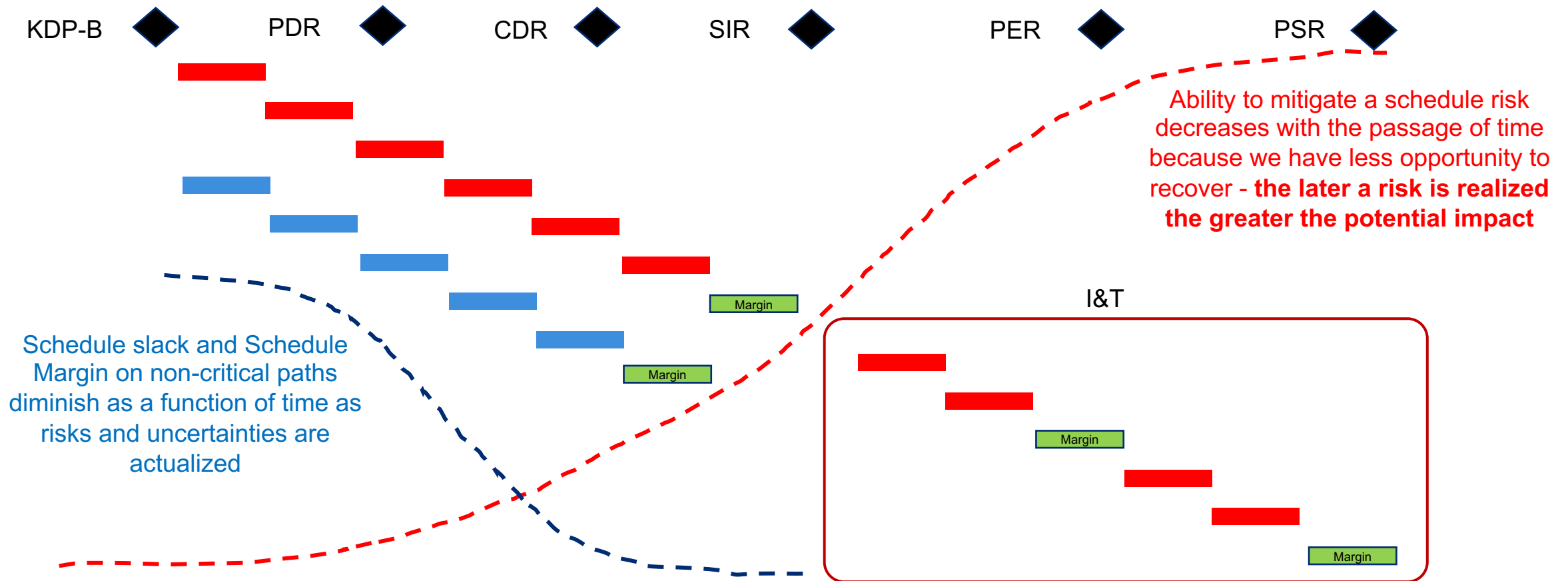
- Anyone who has played Chutes and Ladders and landed on space 87 will find themselves back on space 24 and will be highly unlikely to win

In practice, the severity of a schedule risk impact increases as we progress towards launch



Problem Statement

Our current schedule risk rating methodology struggles to account for risk escalation with respect to project lifecycle - a schedule slip of 3 months at the start of Phase B poses significantly less schedule risk than a schedule slip of 3 months during Mission I&T



Why are we discussing this if the current model “works”?

The current Schedule Consequence Rating Rubric:

- Struggles to convey potential risk severity to a project
- Includes gaps and inconsistencies
- Difficult to Interpret; potential for differing interpretations
- Does not incorporate risk escalation with respect to project lifecycle
- Does not adjust risk impact within continuously evolving IMS
- Does not quantify Schedule Margin nor available Total Slack

The current Risk Consequence Rating Methodology:

- Does not provide the ability to inject risk impacts into project lifecycle and review how risk impacts change as the schedule evolves
- Is not an automated process incorporating Total Slack/Schedule Margin and must be done manually if/when an update is conducted



Square wheels will get you there, but round wheels are more accurate, efficient and you will lose less 'rocks' along the way

Sample Project Examples

Example 1:

Risk 1: If Project X fails in Power subsystem-level testing, then we will need to do Y which will cause a 3 month schedule impact.

vs

Risk 2: If Project X fails in Mission I&T TVAC, then we will need to do Y, which will cause a 3 month schedule impact.

*Both risks yield a potential 3 month schedule slip, but what if Risk 1 has 100 days of Total Slack and 200 days of available Schedule Margin and Risk 2 has 0 days of Total Slack and only 20 days of Schedule Margin? Does a '3 month schedule slip' really mean the same thing?

Example 2:

Risk 3: The material used on Board Z may not pass test/inspection and would require a new material be procured, designed and implemented.

- Risk details when added in Phase B:
 - Medium likelihood, Low consequence
 - Schedule path carried 100 days of Slack and 120 days of Schedule Margin
- Risk details when the risk became realized in Testing/Inspection:
 - Risk realized, High consequence
 - Slack had eroded to 0 days and available Schedule Margin was reduced to only 60 days

*Had the project fully understood the impact of the eroding Total Slack and Schedule Margin over time, they would have tracked the risk with much higher consequence severity

Solution

Improve the Risk Consequence Rating Rubric to account for risk escalation with evolving IMS. Create a Dynamic Risk Consequence Rating Methodology where the estimated impact of the risk is applied to the impacted activities and measure the response on an iterative/monthly basis.

- Risk Consequence Rating Rubric
 - Fills gaps and inconsistencies of current model
 - Eliminates potential for differing interpretations
 - Quantifies Schedule Margin and Total Slack
 - Accounts for risk escalation with respect to project lifecycle
 - Accounts for current risk impact within evolving IMS
- Dynamic Risk Consequence Rating Methodology
 - Ability to inject risk impacts on a monthly basis to review how risk impacts change as the schedule evolves
 - Automated process utilizes MS Project Visual Basic script to insert risk impact and generate a results report in Excel

Rating	NASA S3001 - Schedule Consequence	Dynamic Model - Schedule Consequence
1	Minimal consequence	*Non-Mission Critical Path schedule slip. *Mitigation by Slack with >40 days Total Slack remaining. *No Impact to Schedule Margin.
2	Critical path is not slipped; total slack of slipped tasks will not impact critical path in less than 10 days	*Non-Mission Critical Path schedule slip. *Mitigation by Slack with <40 days Total Slack remaining. *No Impact to Schedule Margin.
3	Critical Path is not slipped; total slack of slipped tasks is within 10 days of impacting the critical path	*Mission Critical Path schedule slip. *Accommodated within Schedule Margin at Subsystem/Instrument Level
4	Critical path slips	*Mission Critical Path schedule slip. *Accommodated within Schedule Margin at Mission I&T Level
5	Critical path slips and one or more critical milestones or events cannot be met	*Mission Critical Path - Launch Slip

Current Static Risk Rating vs Dynamic Risk Rating

Current Static Risk Rating	Dynamic Risk Rating
Advantages	
Familiar to current users	More visibility on schedule margin and slack degradation
5x5 Matrix	Objectively (vs Subjectively) based on set schedule criteria (slack, schedule margin, occurrence in project life cycle)
	Earlier insight into rating trending
	Opportunity to reevaluate risk consequence rating
	5x5 Matrix
Disadvantages	
Gaps and Inconsistencies	No differential between launch slip severity
Difficult to Interpret; Potential for different interpretations	Realignment from NASA approach
Does not take into account risk escalation with respect to project life cycle	
Does not take into account risk impact within evolving IMS	
Does not quantify schedule margin or slack	

Rating	NASA S3001 - Schedule Consequence	Dynamic Model - Schedule Consequence
1	Minimal consequence	*Non-Mission Critical Path schedule slip. *Mitigation by Slack with >40 days Total Slack remaining. *No Impact to Schedule Margin.
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Mechanics of Automated Solution

- Field Coding (Updated and Maintained by Project Planner(s))
 - Risks & impacts coded in IMS
 - Schedule Margin & “Compressible” activities coded in IMS
- Automated Process Steps
 - Remove deadlines & reduce compressible activity durations by 50% or to a Configurable minimum duration
 - Loop through risks coded in the IMS
 - Zero out margin starting after the latest risk activity finish
 - Record slack value on the latest margin activity in the IMS (Pre-Launch)
 - Inject risk impact
 - Record slack value on the latest margin activity and the minimum slack value on activities coded with the risk ID
 - Restore margin durations
 - Move to next risk
 - Restore deadlines and compressible activity durations
 - Results captured in MS Excel

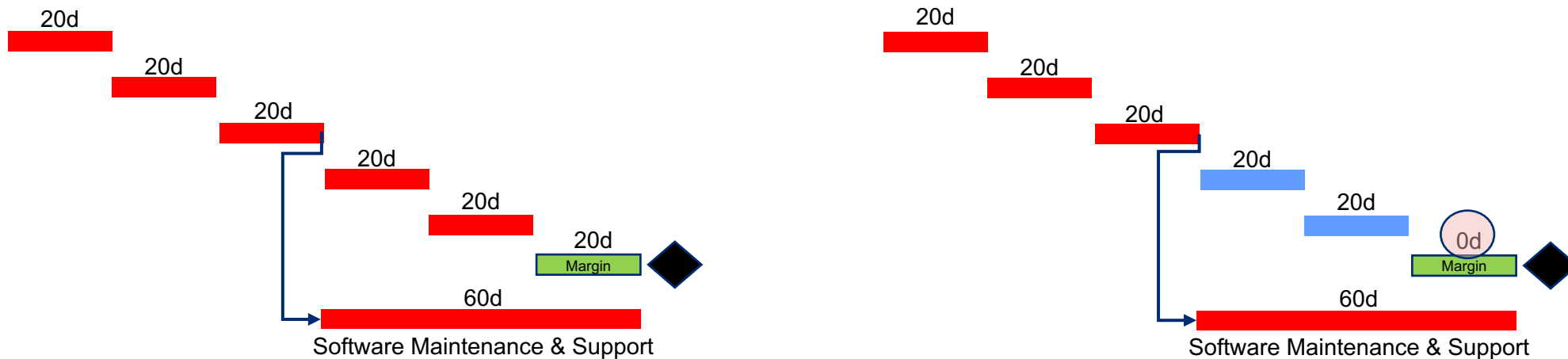
Mechanics of Automated Solution

Issue 1: Compressible Activities

Issue: “Compressible” activities driving the schedule

What is a “Compressible” activity? High duration activities that are supportive in nature (Software Support, Software Development, Test Plans)

Why is it an issue? When the margin is zeroed or a risk is injected these activities may drive the schedule, impacting slack values leading up to delivery.



Solution: Identify and flag compressible activities. Compressible activity durations are reduced by 50% prior to injecting risks and zeroing margin as part of the automated process.

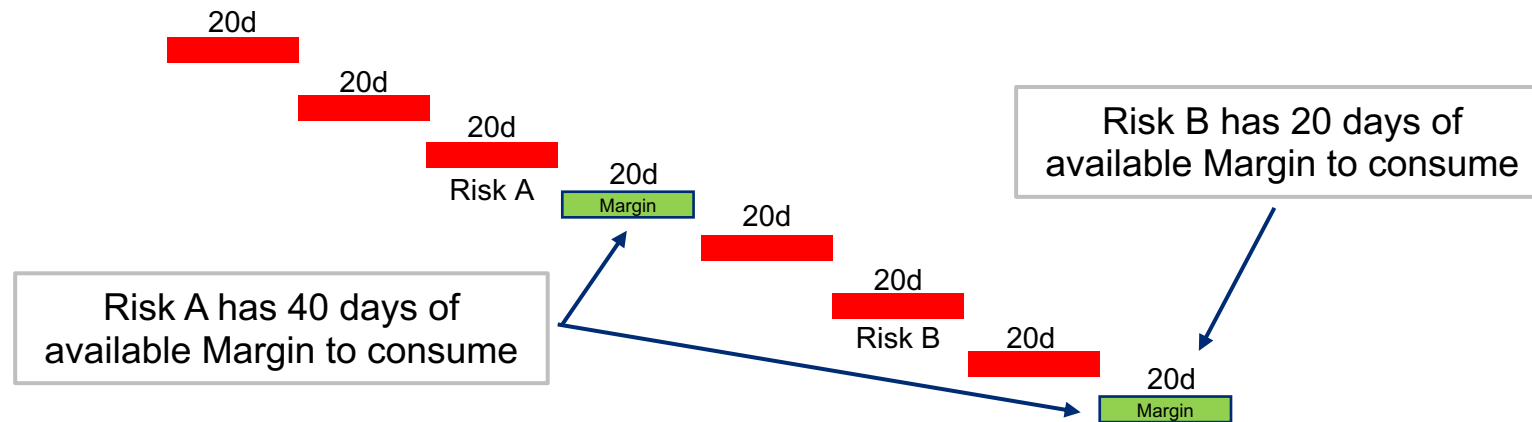
Automated Solution Mechanics of Automated Solution

Issue 2: Zeroing ALL Margin

Issue: Zeroing all margin will give an inaccurate view of available slack and margin a risk activity has available to consume.

Why is it an issue?

Depending on where a risk occurs in the project life cycle, the amount of slack and margin available changes.



Solution: Identify the latest finish date of all the activities associated with a risk and only zero margin activities which start after that finish date.

Mechanics of Automated Solution

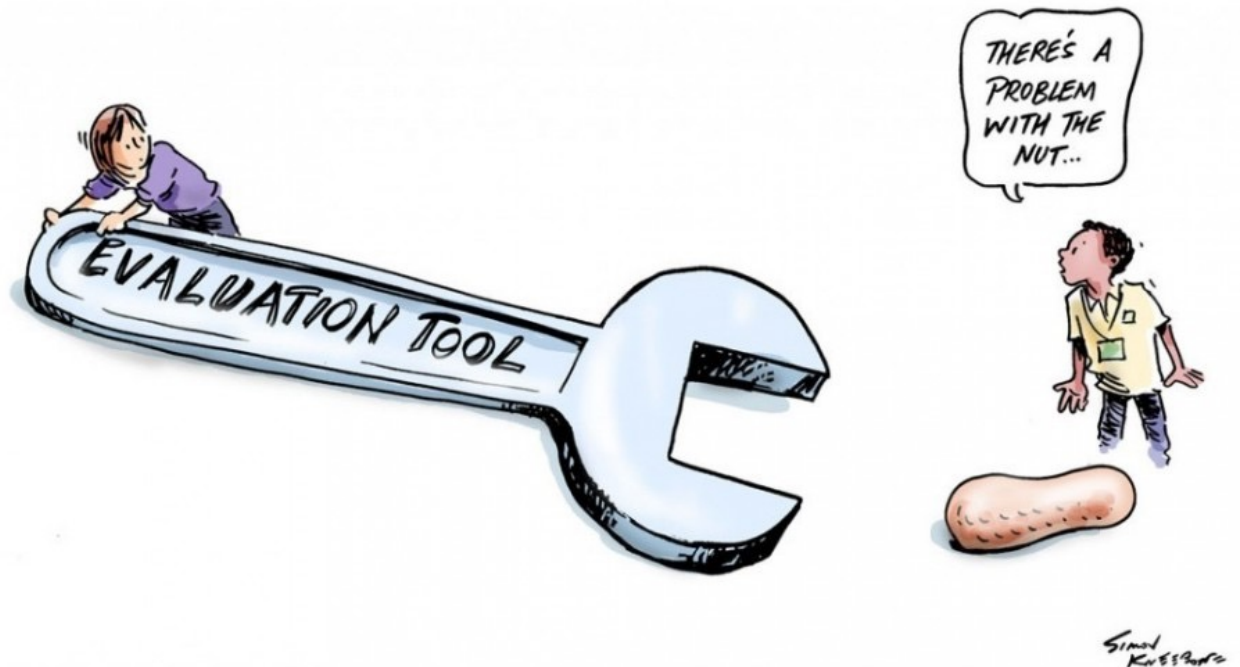
Issue 3 & 4: Deadlines/Hard Constraints & Slack/Schedule Margin

Issue: Deadline/Hard Constraint Impacting Slack Values

Why is it an issue? If hard constraints or deadlines are applied prior to launch, slack values on paths leading up to the constraint or deadline will be calculated to those constraint and deadline dates and not to Launch.

Solution: The only hard constraint should be on the launch milestone. Deadlines can be used by teams for tracking slack against major milestones / events. Deadlines will be removed prior to zeroing margin and injecting risks as part of the automated process.

Issue: Difficult to Differentiate between Slack and Schedule Margin



Conclusion

We can improve our process for rating schedule risks by improving the risk consequence rating definitions and by implementing an automated dynamic solution

- Accurate risk consequence based on life cycle phase and the availability of schedule slack & margin
- Improved rating consequence definitions eliminates ambiguity and conveys risk severity to the sponsor
- Identifies accurate assessment of potential Launch impact



Questions



Contact Information

- Dewey E. Barlow
 - 443-630-9389
 - Dewey.barlow@jhuapl.edu
- Faith Kahler
 - 240-280-4262
 - Faith.kahler@jhuapl.edu
- Ryan Smith
 - 240-228-0487
 - Ryan.smith@jhuapl.edu
- Andrew Soukup
 - 240-592-2987
 - Andy.Soukup@jhuapl.edu



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