

Using Risk Drivers and Integrating Cost/Schedule Risk Analysis with Acumen RISK

Acumen Summit, Houston TX

October 1, 2013

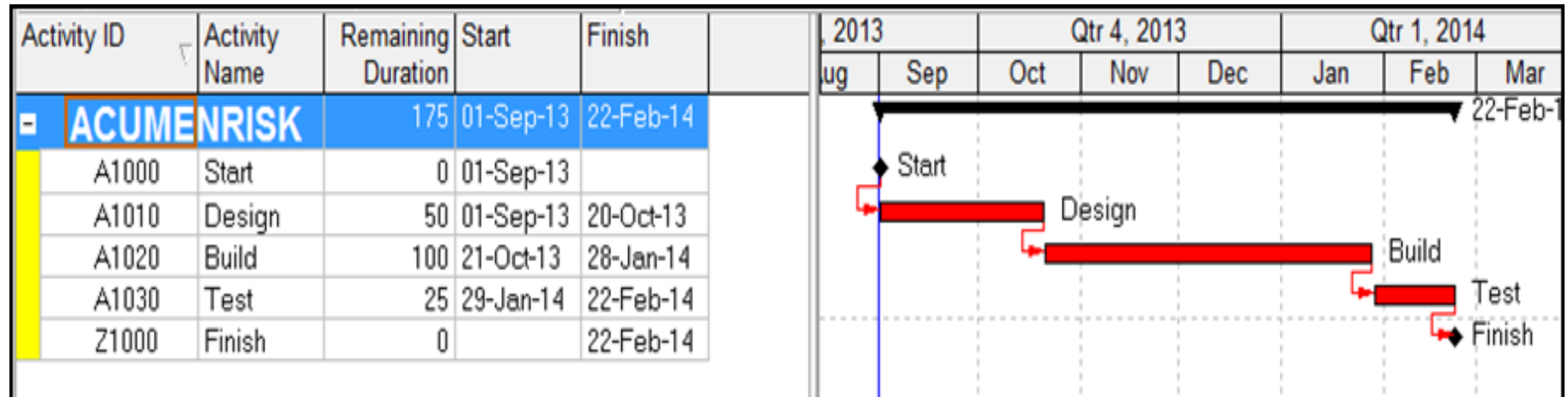
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Agenda

- Simple schedule with uncertainty
- Correlation with uncertainty
- Probabilistic event – recovery from test failure
- Risk Register provides the Risk Drivers
- Risk Drivers on one or several activities
- Cost Risk
- Integrating cost risk and schedule risk

Simple Schedule in Primavera P6



Adjust the Uncertainty Ranges

Name	Type	Min	Most Likely	Max
Very Conservative	Triangle	80%	90%	100%
Conservative	Triangle	85%	100%	105%
Realistic	Triangle	90%	100%	110%
Aggressive	Triangle	95%	110%	125%
Very Aggressive	Triangle	100%	120%	150%

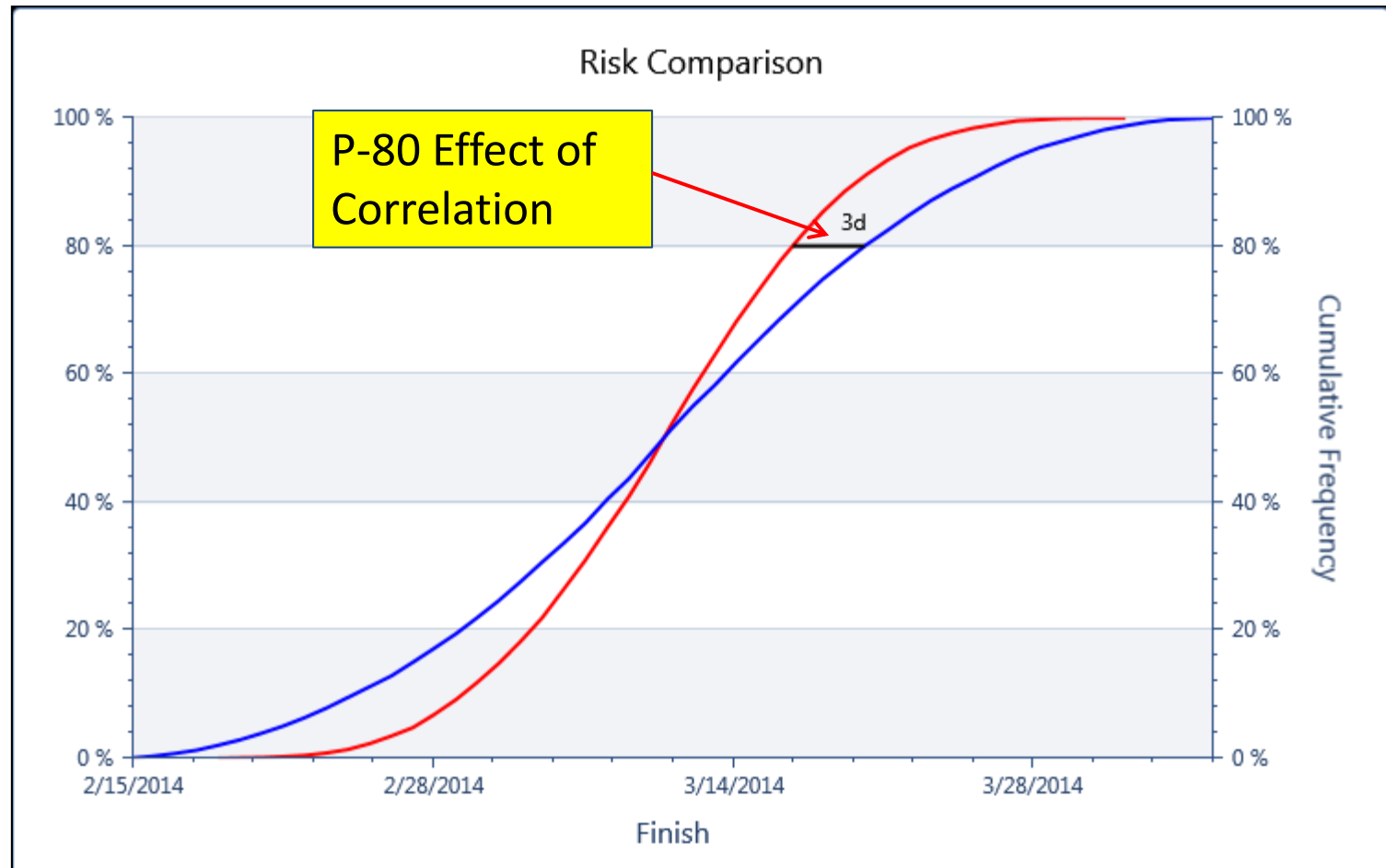
The default values can be edited. Notice that for “Aggressive” and “Very Aggressive” we suggest that the Most Likely durations are **NOT** the same as in the schedule, but are 10% and 20% longer, respectively.

Adding Uncertainty to Schedule

	Description	Remaining...		Duration Uncertainty	Type		%	CLT	Cor...	Rem....	Start	Finish	To
RISK	ACUMENRISK	175		OFF						24w	9/1/2013	2/22/2014	
IMENRISK	ACUMEN RISK Cas...	174		OFF						24w	9/1/2013	2/22/2014	
A1000	Start	0					100 %			0w	9/1/2013	9/1/2013	
A1010	Design	50		OFF			100 %			7w	9/1/2013	10/20/2013	
A1020	Build	100		OFF			100 %			14w	10/21/2013	1/28/2014	
A1030	Test	25		OFF			100 %			3w	1/29/2014	2/22/2014	
Z1000	Finish	0					100 %			0w	2/22/2014	2/22/2014	

Decided that the schedule durations as estimated are “aggressive”

The Effect of Correlation with Uncertainty



Add a Probabilistic Activity

Activity ID	Activity Name	Remaining Duration	Start	Finish		2013	Qtr 4, 2013				Qtr 1, 2014			Qtr 2, 2014		
						Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
ACUMENRISK ACUMEN RI		200	01-Sep-13	19-Mar-14		19-Mar-14, ACUMENRISK ACUMEN RI										
A1000	Start	0	01-Sep-13			Start										
A1010	Design	50	01-Sep-13	20-Oct-13			Design									
A1020	Build	100	21-Oct-13	28-Jan-14				Build								
A1030	Test	25	29-Jan-14	22-Feb-14							Test					
A1040	Recover from Failing the Test	25	23-Feb-14	19-Mar-14								Recover from Failing the Test				
Z1000	Finish	0		19-Mar-14									Finish			

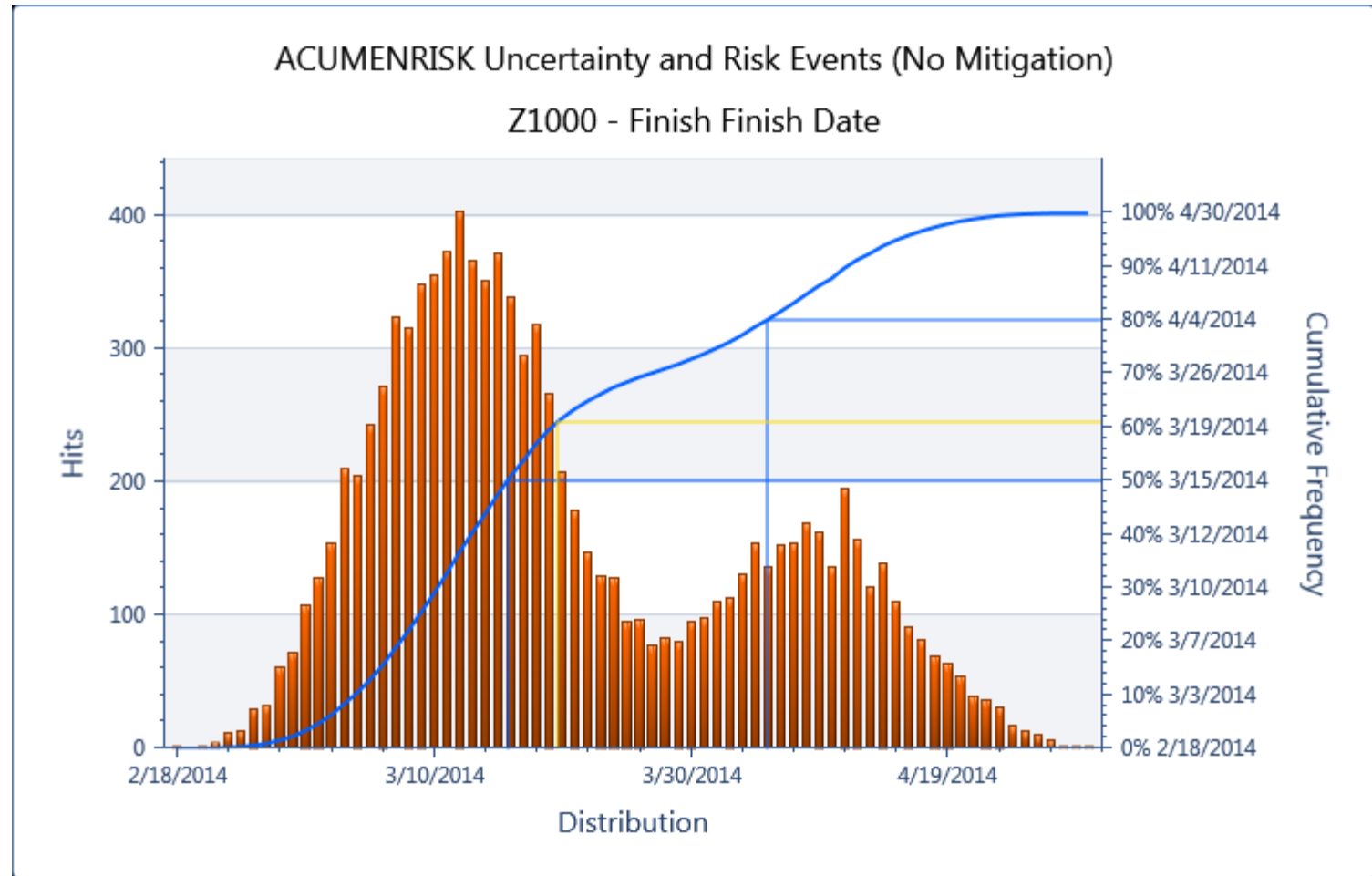
Input an estimated schedule duration. Acumen RISK allows this to happen with some probability <100, including 0%

It is 30% Likely that We will Fail the Test

	Description	Remaining...		Duration Uncertainty	Type		%	CLT	C
MENRISK	ACUMENRISK	200		OFF					
ACUMENRISK	ACUMEN RISK Case Study	199		OFF					
A1000	Start	0					100 %		
A1010	Design	50		OFF			100 %		
A1020	Build	100		OFF			100 %		
A1030	Test	25		OFF			100 %		
A1040	Recover from Failing the Test	25		OFF			30 %		
Z1000	Finish	0					100 %		

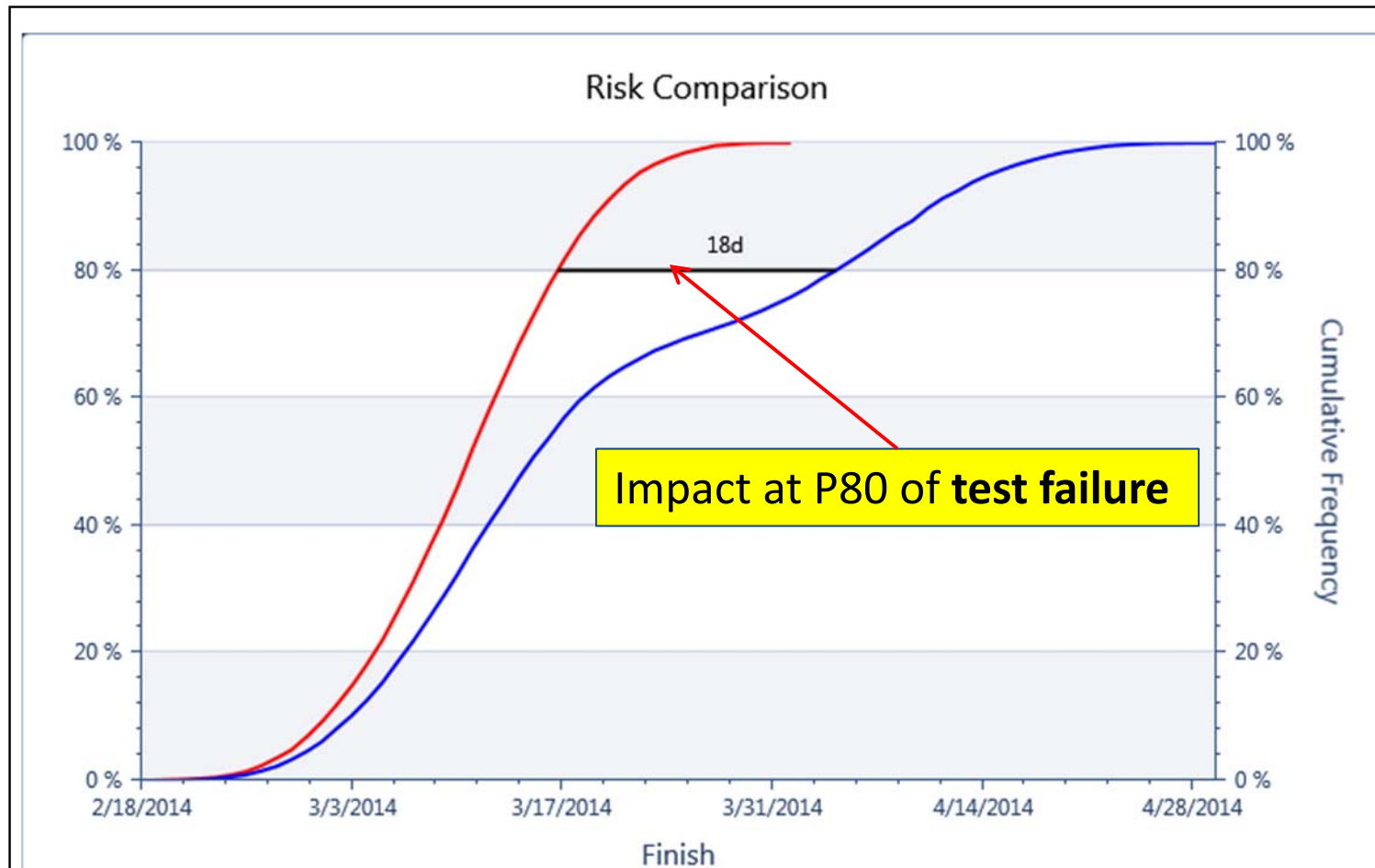
The Probabilistic Activity Recover from Failing the Test will occur with the 30% likelihood of failing the test

Could create a bi-modal Distribution



The “shoulder” of the cumulative distribution is at 70%, the probability that we pass the test the first time

Compare the two results



Getting to Risk Drivers

The Risk Register Template

Event Template Editor

Template

Open Save

File

Probability Ranges Impact Ranges Color Thresholds Auto Score Auto Range Calibrate

Schedule Impacts in Percentage of Schedule RDUR

Event Impact Template

Type	% Based	Very Low	Low	Medium	High	Very High
Schedule	<input checked="" type="checkbox"/>	<10%	<25%	<50%	<75%	<100%
Cost	<input type="checkbox"/>	<\$5	<\$10	<\$15	<\$20	<\$25

Probability / Scoring Template

Name	Min Value	Very Low	Low	Medium	High	Very High
Very High	>75%	5	10	15	20	25
High	>50%	4	8	12	16	20
Medium	>25%	3	6	9	12	15
Low	>10%	2	4	6	8	10
Very Low	<=10%	1	2	3	4	5






Risk Register Custom Fields

Name	Is Enabled
Custom Field 2	<input type="checkbox"/>
Custom Field 3	<input type="checkbox"/>

The Red / Yellow / Green regions of the 5x5 matrix are configurable

OK

Add Risk Drivers Using the Risk Register

Risk Register										
Drag a column header here to group by that column										
Risk						Current				M
Enabled	Mapped	ID	Type	Name		Probability	Schedule	Cost	Score	En
<input checked="" type="checkbox"/>	<input type="checkbox"/>									
<input checked="" type="checkbox"/>	<input type="checkbox"/>	R4		Communication between partners lacking		High (50... 	Medium	Negligible	12	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	R3		Testing may be unpredictable		Medium	Very High	Negligible	15	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	R2		Construction supervision may be lacking		Medium	Medium	Negligible	9	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	R1		Design Productivity may be Low		High	Medium	Negligible	12	

Using the definitions from the Risk Matrix Template. Impacts are adjusted because they apply to the activity durations, not to the overall schedule

Assign Risk Drivers to Activities

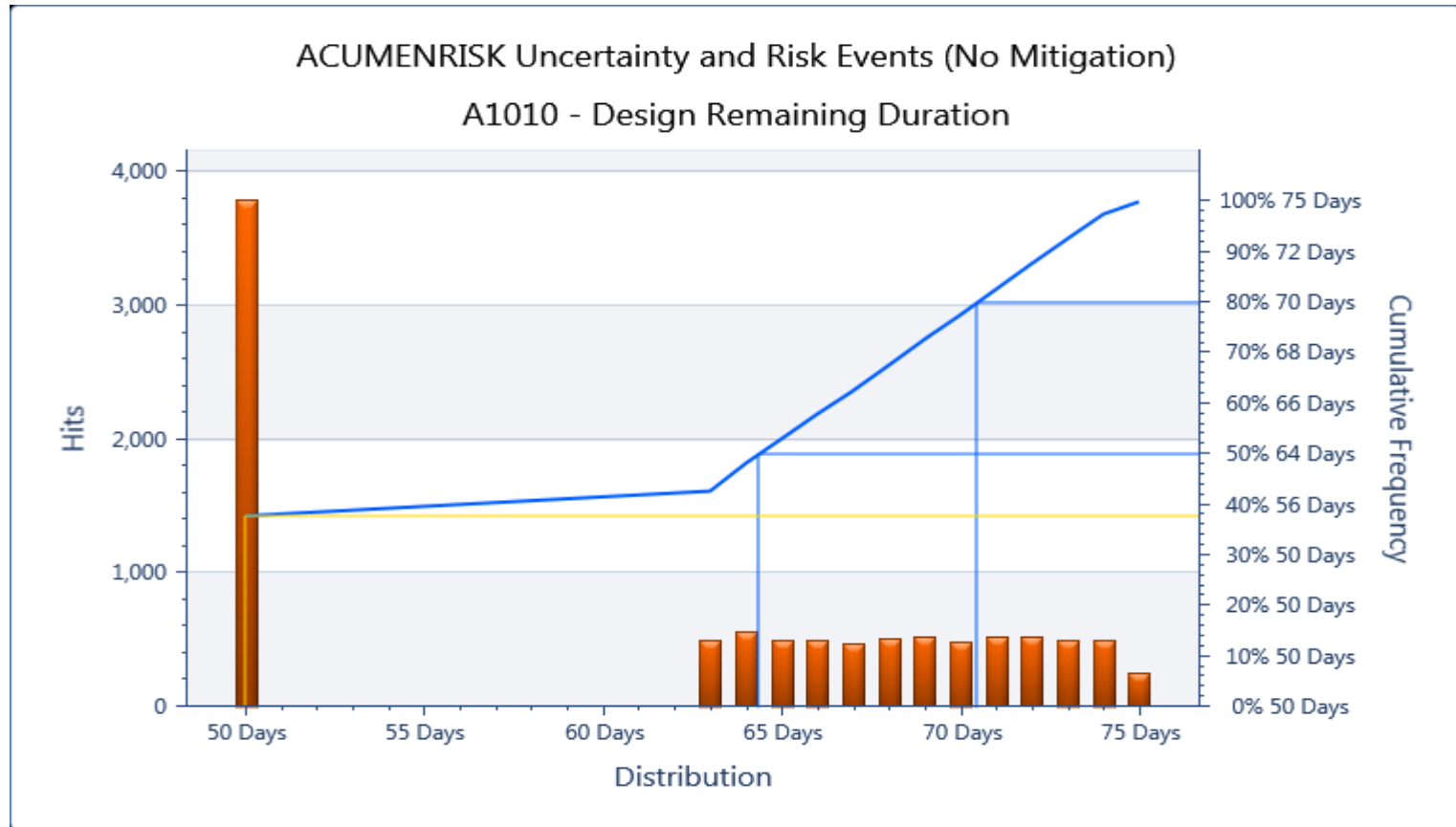
Id	Description	Remaining...		Duration Uncertainty	Type		%
ACUMENRISK	ACUMENRISK	175					
ACUMENRISK	ACUMEN RISK Cas...	174					
A1000	Start	0					100 %
A1010	Design	50					100 %
A1020	Build	100					100 %
A1030	Test	25					100 %
Z1000	Finish	0					100 %

Uncertainty turned off

sk Event Mapping - ACUMEN RISK Case Study							
Mapping			Current				
R...	Activity	Event	Min Proba...	Max Proba...	Min Durati...	Max Durat...	Min
✗	A1020: Build	Construction supervision may be l...	25 %	50 %	25 %	50 %	
✗	A1010: Design	Design productivity may be low	50 %	75 %	25 %	50 %	
✗	A1030: Test	Testing may be unpredictable	25 %	50 %	75 %	100 %	

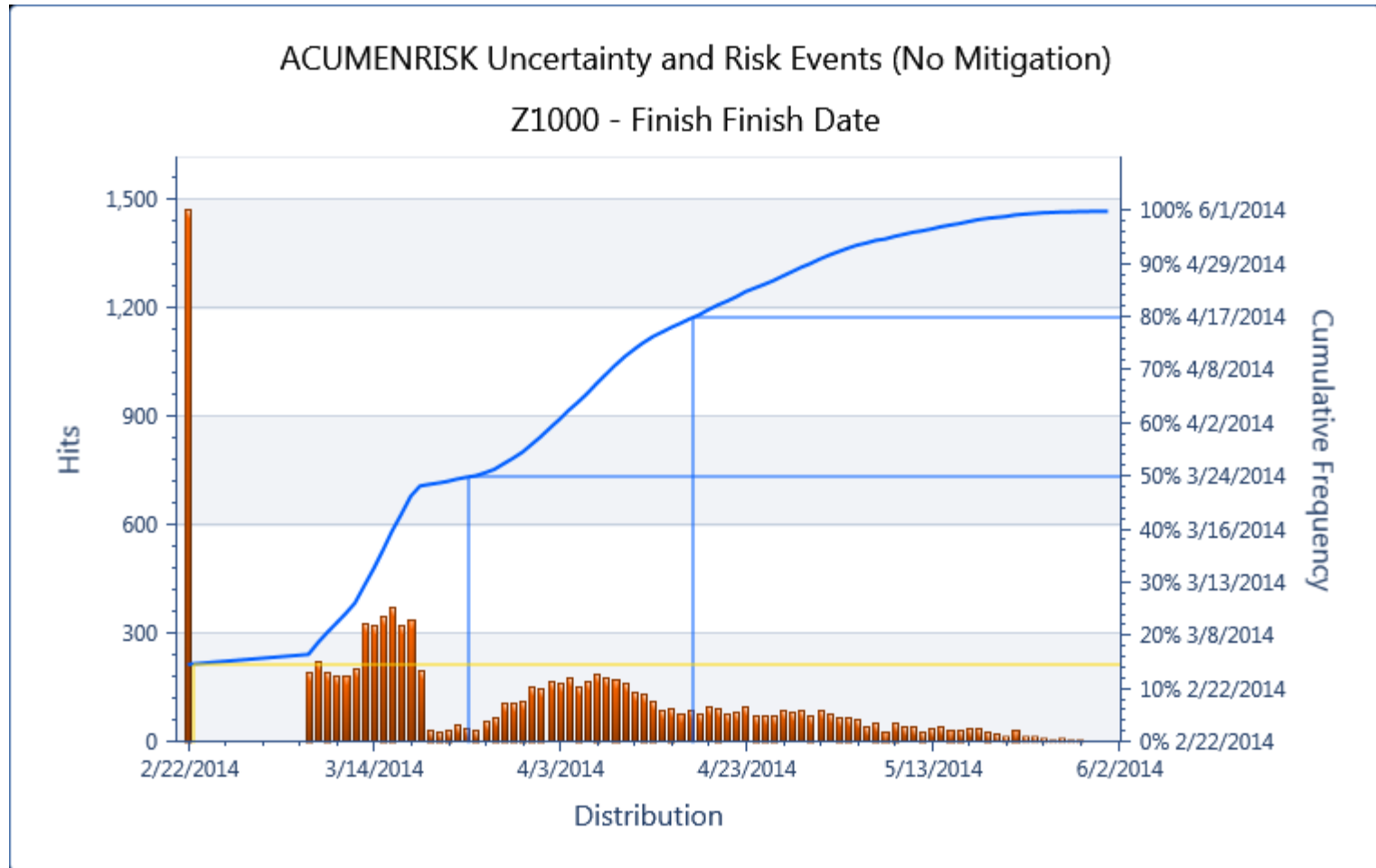
In this case each activity has just one risk assigned. These risks have a *probability* at the mid-range and *impact* as a uniform distribution between Min Duration and Max Duration impact in the Risk Register

Activity Design Duration shows “Spike”



Spike represents the risk's not happening. Probability for Design Risk is “High” between 50% and 75%. This translates to 62.5% happening, 37.5% not happening, so in 3,750 of 10,000 iterations the 50-day remaining duration is deemed / simulated as accurate

Project Finish Date with Risk Drivers



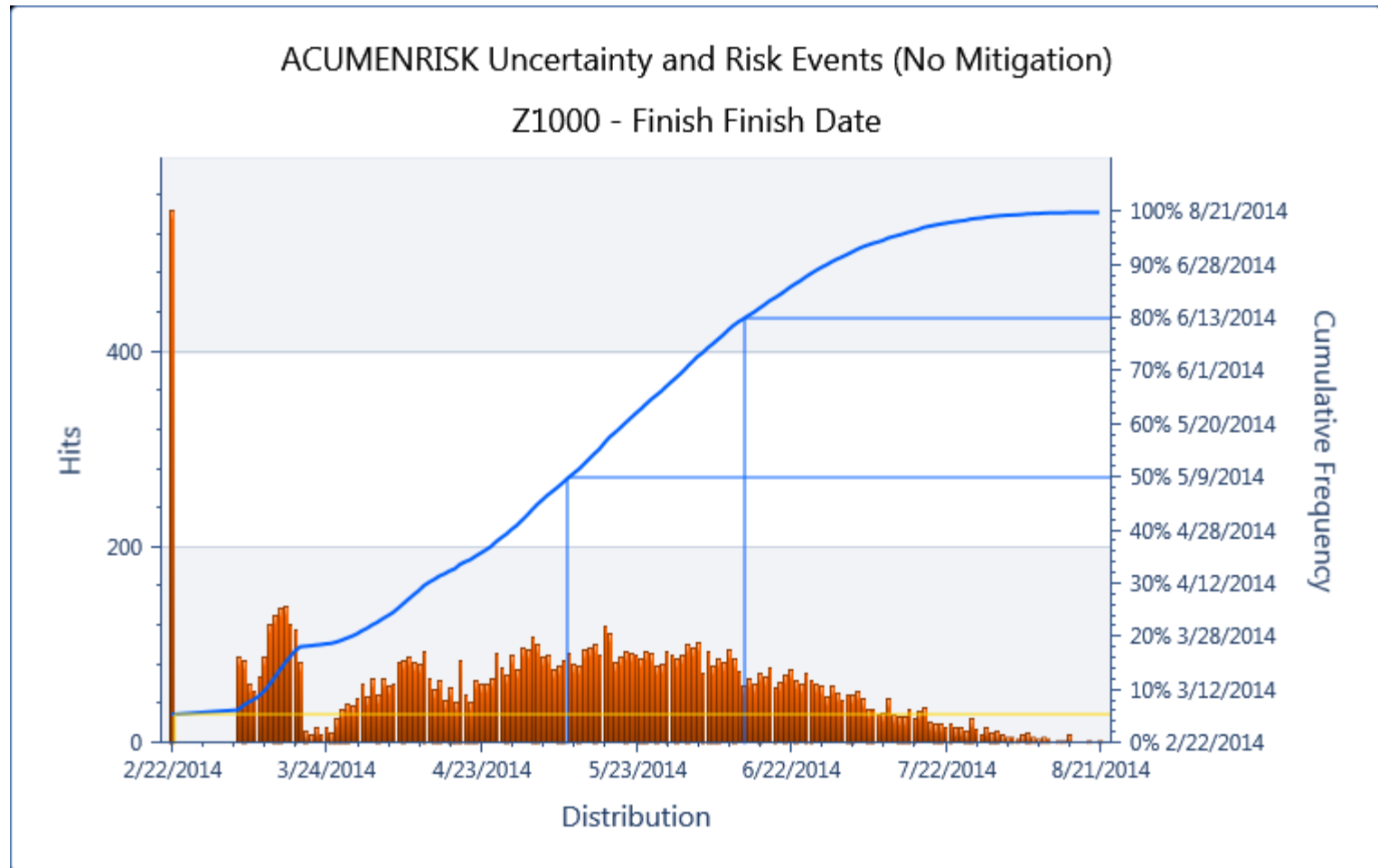
Schedule date is 2/22/2014. Here the 80th percentile is 4/17/14, two months late with 3 assigned risk events and no uncertainty

Add a Risk Driver that is Assigned to Multiple Activities

Risk Register									
Drag a column header here to group by that column									
Risk					Current				
Enabled	Mapped	ID	Type	Name	Probability	Schedule	Cost	Score	
<input type="checkbox"/>	<input type="checkbox"/>								
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	R1		Design productivity may be low	High	Medium	Negligible	12	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	R2		Construction supervision may be l...	Medium	Medium	Negligible	9	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	R3		Testing may be unpredictable	Medium	Very High	Negligible	15	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	R4		Communication between partners...	High	Medium	Negligible	12	

Mapping			Current				
R...	Activity	Event	Min Proba...	Max Proba...	Min Durati...	Max Durat...	Min
X	A1010: Design	Communication between partners...	50 %	75 %	25 %	50 %	
X	A1020: Build	Communication between partners...	50 %	75 %	25 %	50 %	
X	A1030: Test	Communication between partners...	50 %	75 %	25 %	50 %	
X	A1010: Design	Design productivity may be low	50 %	75 %	25 %	50 %	
X	Communication between partners affects all of the project tasks						
X	A1030: Test	Testing may be unpredictable	25 %	50 %	75 %	100 %	

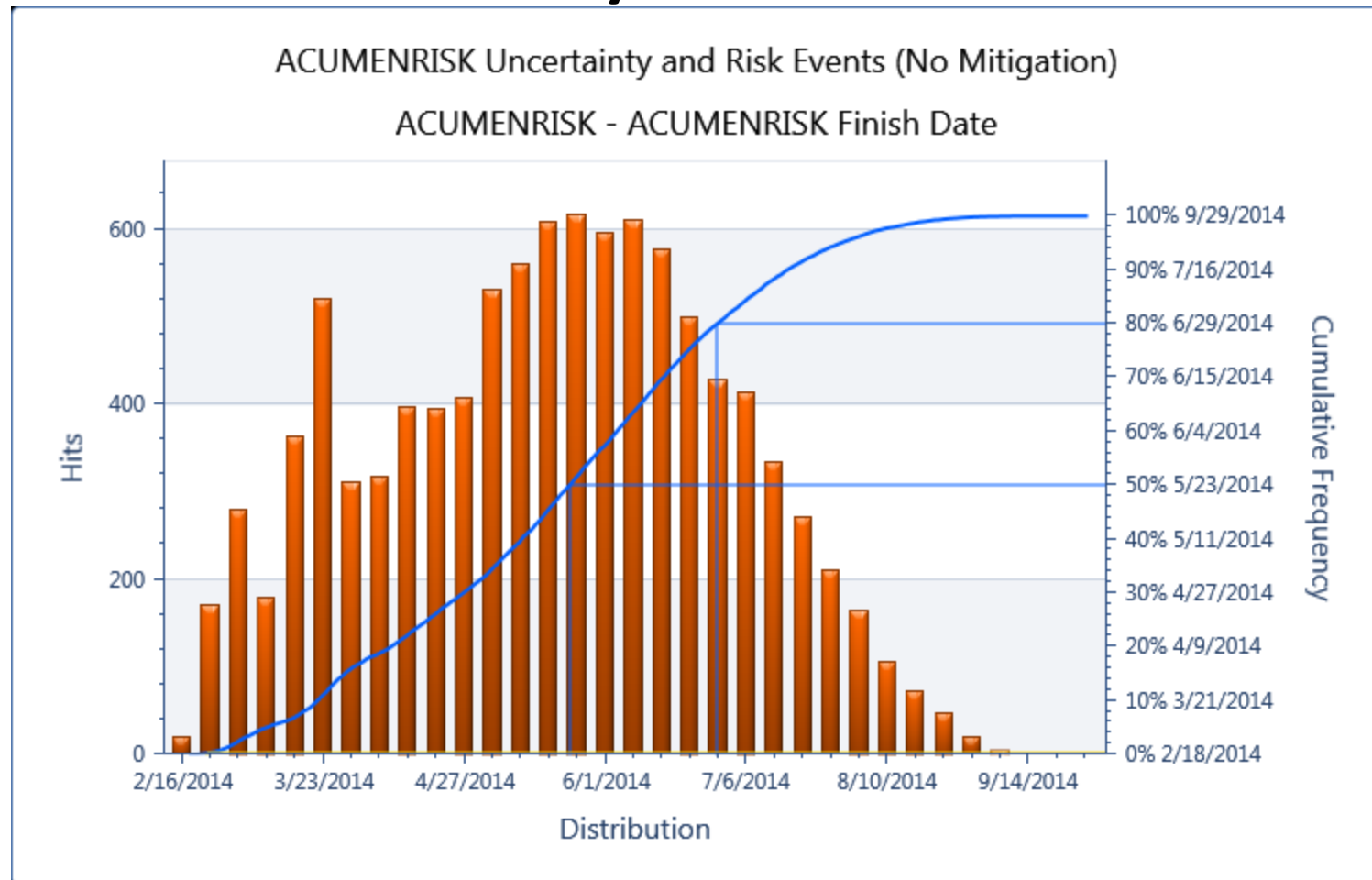
With the Partner Communication Risk the P-80 is 6/13/2014, Adds 2 months



Adding the Partner Communication Risk adds 57 days at the P-80



Add Uncertainty to the Risk Drivers

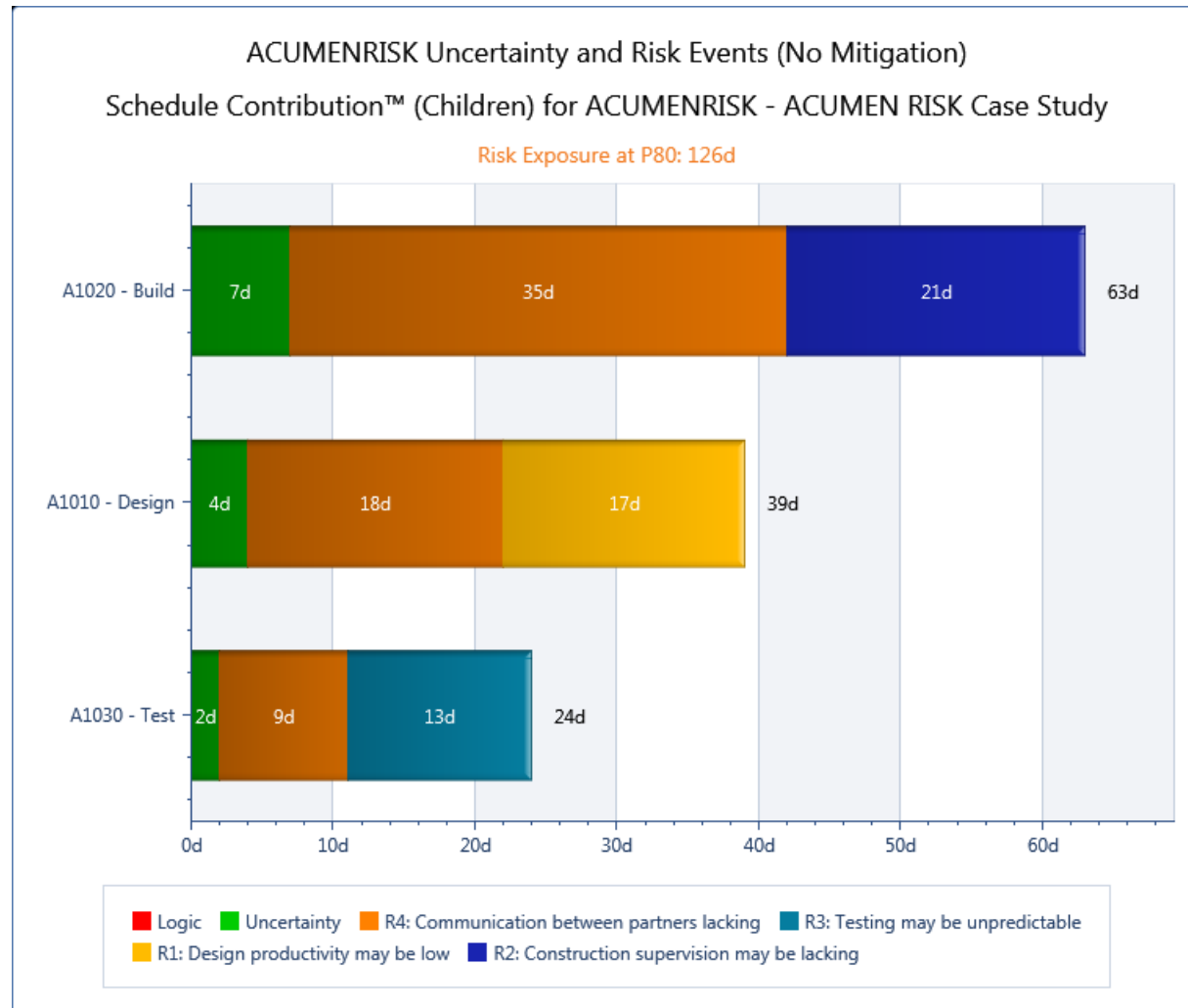


Aggressive Uncertainty has been moderated to 95% - 105% - 115% since it does not have to represent the risk events that have now been entered separately

Adding Uncertainty to the Schedule adds 16 Days at P-80



Risks & Uncertainty that Drive each of the Activities' Durations



Adding Cost Estimate to the Analysis

A	B	C	D	E	F
ID	WBS	Description	Actual Cost	Remaining Cost	Total Cost
5	1	Total Cost		\$0	\$0
10	1.1	Indirect Cost		45,000	45,000
20	1.2	Design Engineering		40,000	40,000
30	1.3	Construction Labor		120,000	120,000
40	1.4	Testing Labor		25,000	25,000
50	1.5	Raw Materials		40,000	40,000
60	1.6	Installed Equipment		50,000	50,000

We have:

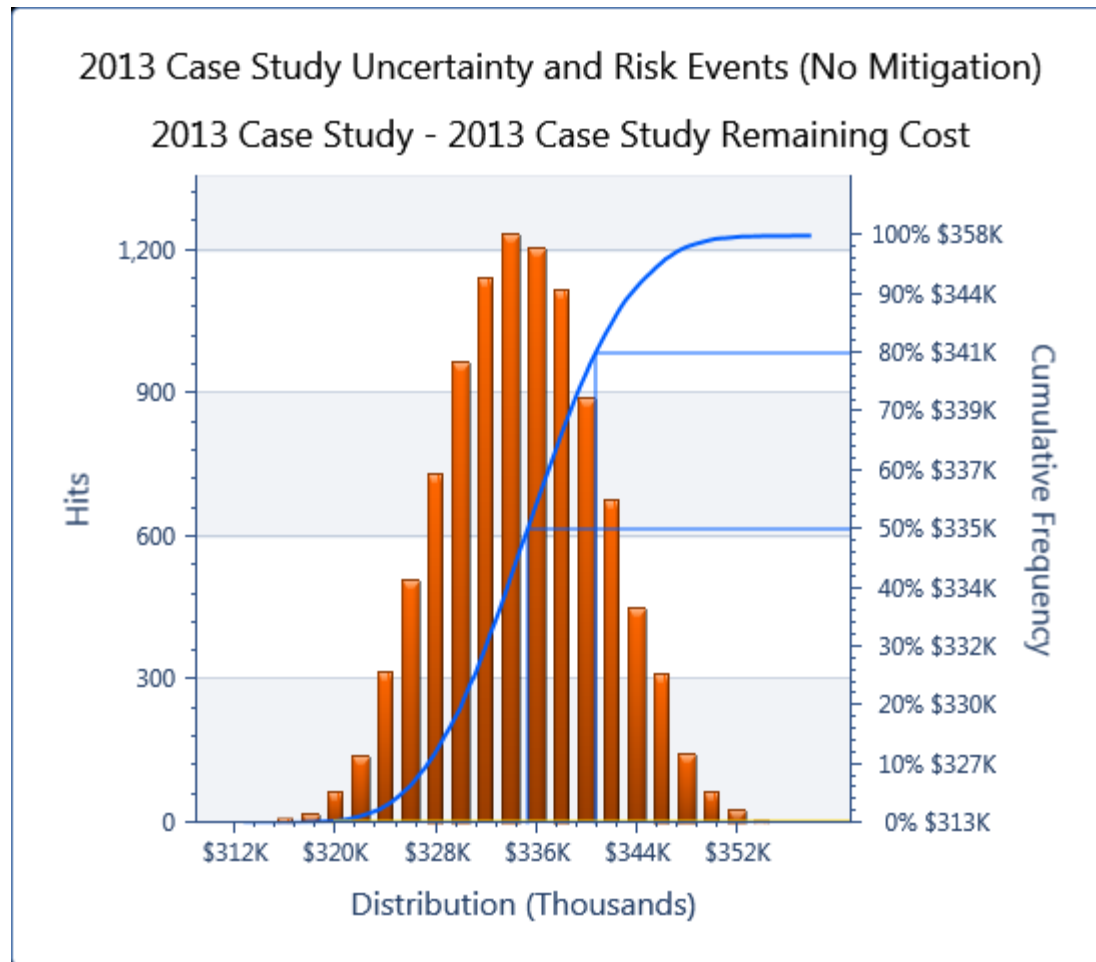
- 3 time-dependent (labor) resources and
- 2 time-independent (materials, equipment) resources
- Total cost = \$320,000 (without padding for risk)

Add Uncertainty to the Cost Elements

Activities										
Analysis				Templates		Risk Models		Publish		
Id	Description	Remaining Cost		Cost Uncertainty	Type		%	CLT		Activity Schedule...
-	Blank Template	Blank Template	\$1,425,000							
10	Design labor	\$150,000					100 %			
20	Construction Labor	\$500,000					100 %			
30	Testing labor	\$250,000					100 %			
40	Procured Materials	\$325,000					100 %			
50	Procured Equipment	\$200,000					100 %			

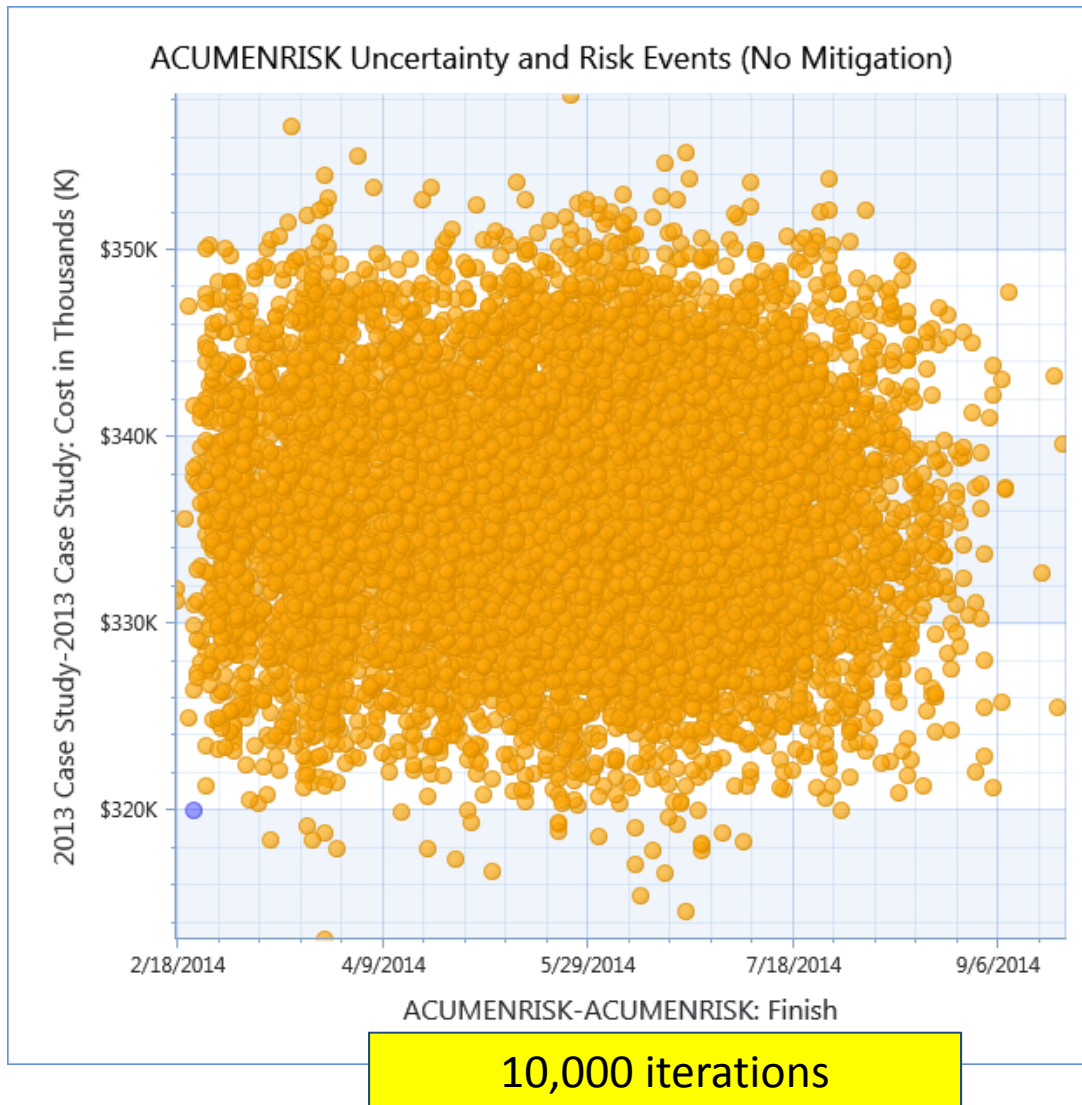
We could add Risk Drivers to these Cost elements as well

Cost Uncertainty, No Schedule Impacts



Base cost is \$320,000. With 95%-105%-115% uncertainty the P-80 is \$341,000

Cost – Schedule Scatter with NO EFFECT of Schedule Risk on Cost Risk



Unless time can drive cost of time-dependent (labor-type) resources the cost and finish dates are not related. In other words, without integrating schedule and cost risk we are missing the standard wisdom that “time is money” and we UNDERESTIMATE cost risk

Integrated Cost Schedule Risk Analysis

– Add Schedule Risk to Cost

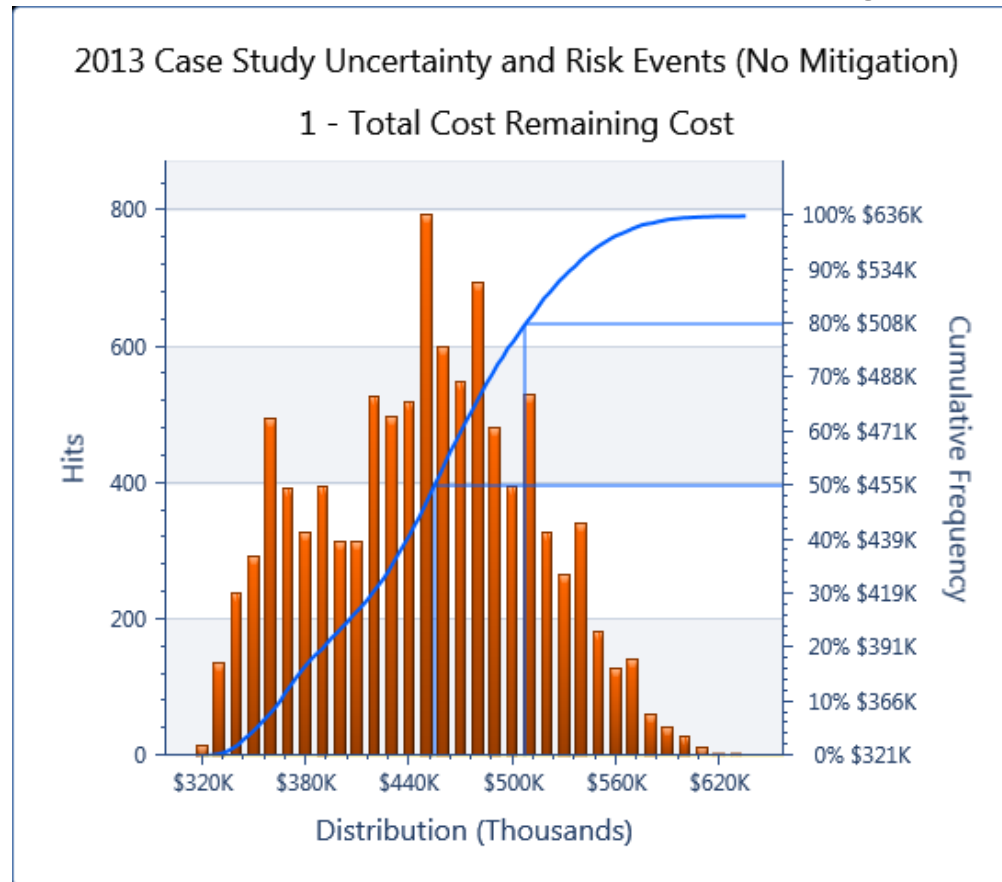
	Description	Remaining Cost		Cost Uncertainty	Type		%	CLT		Activity Schedule...
2013 Case Study	2013 Case Study	\$320,000		OFF						
1	Total Cost	\$320,000		OFF						
10	Indirect Cost	\$45,000		OFF			100 %			ACUMENRISK
20	Design Engineering	\$40,000		OFF			100 %			A1010
30	Construction Labor	\$120,000		OFF			100 %			A1020
40	Testing Labor	\$25,000		OFF			100 %			A1030
50	Raw Materials	\$40,000		OFF			100 %			
60	Installed Equipment	\$50,000		OFF			100 %			

Schedule Risk affects Cost Risk:

- Design schedule risk affects Design Labor cost
- Build schedule risk affects Construction Labor cost
- Testing schedule risk affects Testing Labor cost
- Total Schedule Risk affects Indirect Costs (overhead, Project Management)

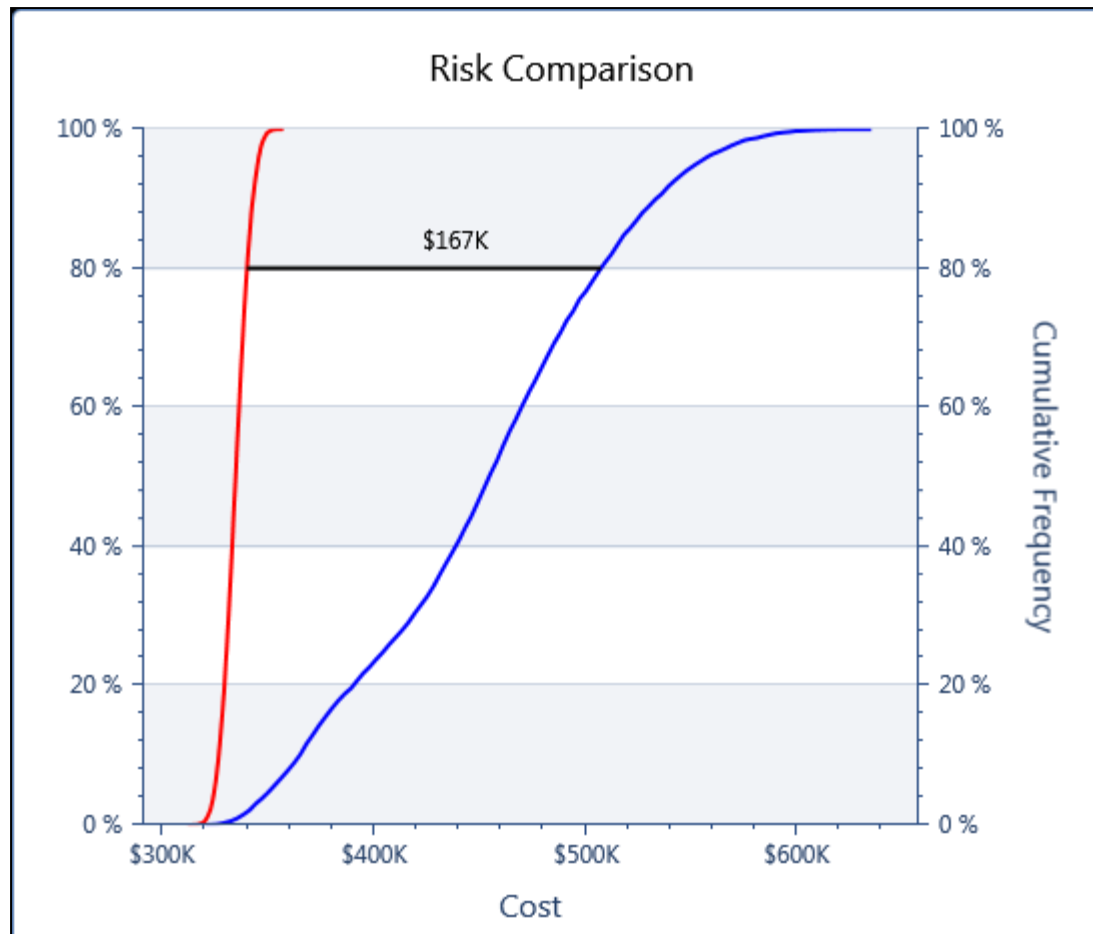
Procured Materials and Equipment costs are uncertain but not because of schedule risk

Cost Results with Uncertainty and Schedule Risk Impacts

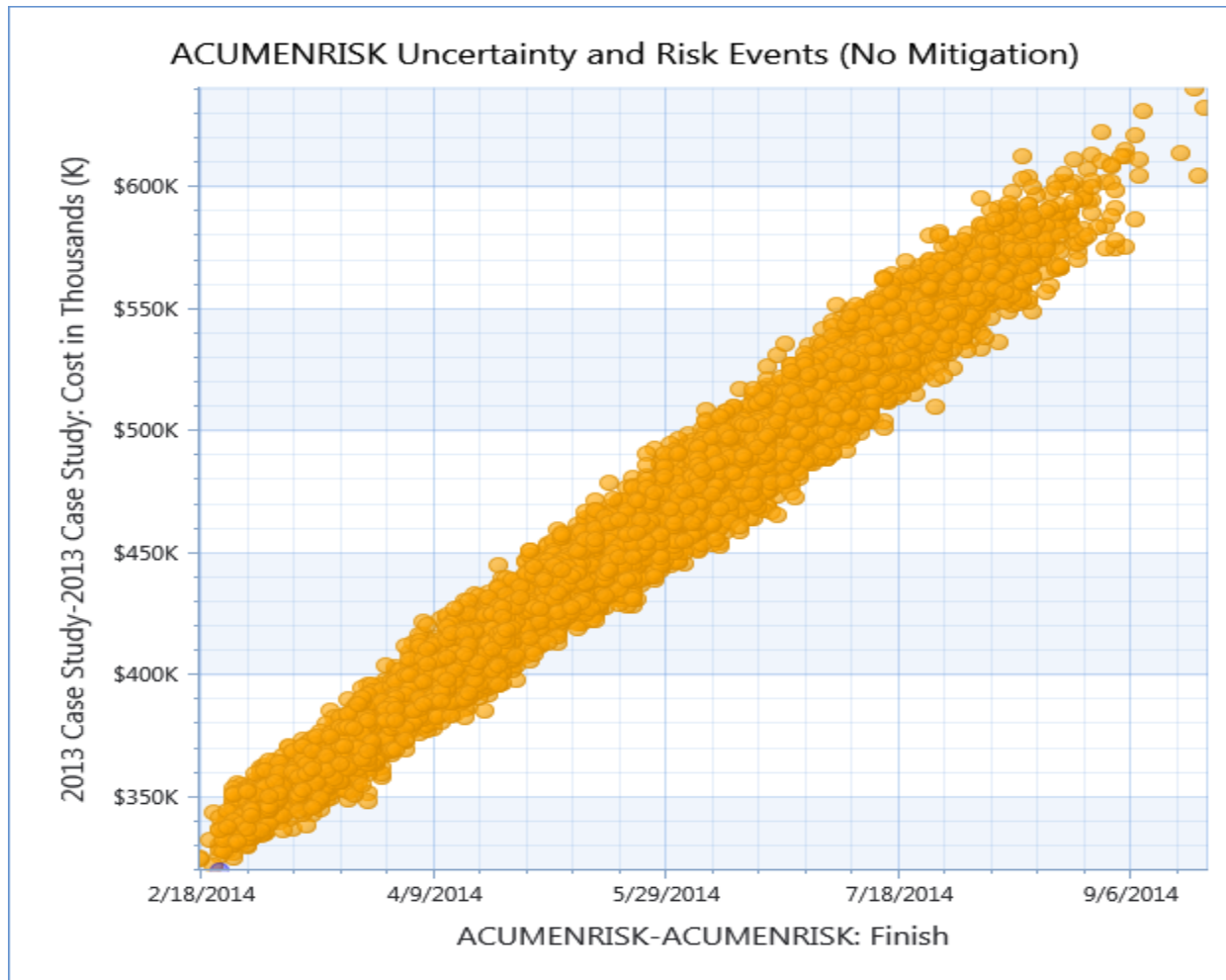


Base cost is \$320,000. With uncertainty the P-80 is \$341,000. Adding schedule risk to the Labor resources the P-80 is \$508,000, for a total cost contingency of \$188,000. Schedule risk adds \$167,000 by itself in this case

Schedule Risk is an Important Driver of Cost Risk, Should not be Ignored



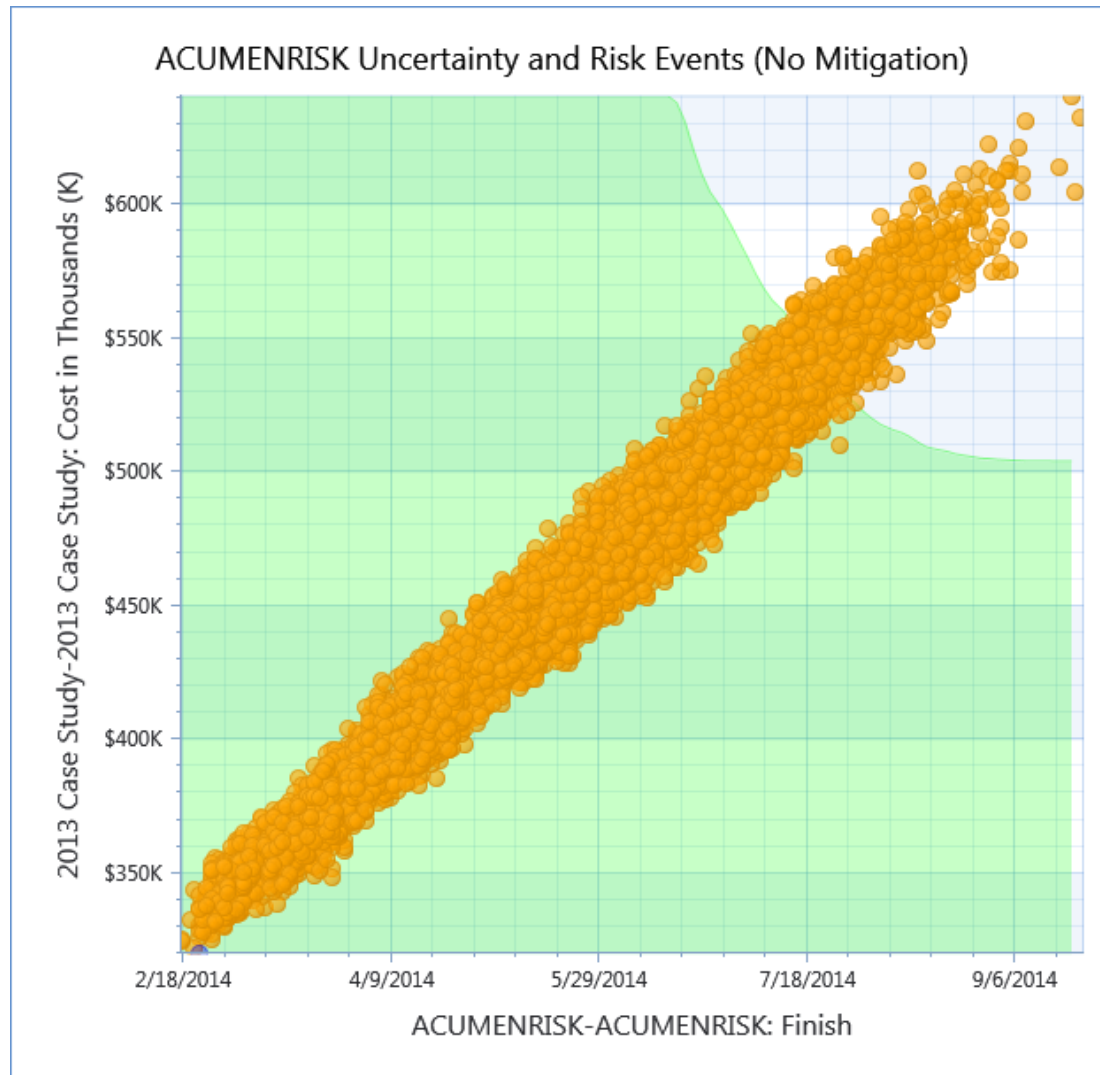
Cost – Schedule Scatter when Schedule Risk Affects Labor Costs



In addition to greater cost risk, allowing schedule risk to drive the cost of Labor resources creates correlation between dates and cost

Cost – Schedule

Joint Confidence Level @ 70%



The boundary describes combinations of cost (for budget) and dates (for schedule) where there is a 70% chance of meeting BOTH

Summary

- Simple schedule with uncertainty
- Correlation with uncertainty
- Probabilistic event – recovery from test failure
- Risk Register provides the Risk Drivers
- Risk Drivers on one or several activities
- Cost Risk
- Integrating cost risk and schedule risk

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