### // 5 Steps for Successful Schedule Risk Analysis on CAPEX Projects



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# // Agenda

- Introductions
- The 5 steps
  - 1. Capturing uncertainty: *calibrating the schedule*
  - 2. Identifying risk events: accounting for unknowns...
  - 3. Alternate scenarios: *risk adjusted schedules*
  - 4. Interpreting results: *exposure & drivers*
  - 5. Risk Reduction: reducing risk exposure
- Worked examples







# // Project Risk Analysis

Introduction

### Scheduling

- Science behind forecasting project completion
- Doesn't account for scope uncertainty, unknowns

### Project Risk Registers

- Becoming more prevalent
- Still isolated from true risk analysis

### Risk Analysis

- Gain true insight into schedule achievability
- Pinpoints risk hotspots that will cause delay
- Structured approach to reducing risk exposure



### // Why Bother with Risk Analysis?

Insight from Risk Analysis



- Reveals hidden critical paths
- Brings realism to your forecast
- Managed contingency
- Generates team buy-in to the schedule
- Helps with the likes of IPA certification



# // How Does Risk Analysis Work?

- Based on CPM (scheduling!)
  - Accounts for variability in the forecast
  - Schedule uncertainty
  - Risk events
  - Cost-impact of time...
- Monte Carlo simulation
  - Essentially a brute force approach
  - Highly prone to schedule logic & inputs





### // Model Basis

#### Sound Schedule





### // Building a Risk Model

Alternate Approaches

### **Risk Load Critical Path**

#### - Pros

- Focuses the team in a workshop
- Based on actual schedule

#### - Cons

- Assumes known critical path
- Risk events make this approach flawed
- Dangerous approach to risk modeling
- Doesn't give true picture of risk

#### **Create a Summary Schedule**

- Pros

- Excellent means by which to facilitate a workshop
- Easy to risk load/build risk model
- Cons
  - Lose the logic integrity/calendars/detail of a schedule
  - Separate model to maintain to that of schedule



# // A More Effective Approach

Uncertainty Factor™

#### **Top-Down Categorization**

- Retains true integrity of the project schedule
- Ensures whole schedule is categorized
- Very fast approach
- Removes complexity
- Eliminates crazy rankings

### **Graphical Approach**

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-	Curre	ent	Sch	ed	Current Schedule	706	
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# // Step 1: Capturing Uncertainty

#### Background

- Uncertainty
  - variability regarding durations/costs
- Is the duration realistic?
  - Scope definition
  - Complexity of work
  - Past performance
  - Just plain wrong!
- Not dates!
  - Dates are the results of durations & logic
- Old school approach
  - Min, most likely, max & distribution type

#### Uncertainty Factor™





### // Step 2: Capturing Risk Events

### **Risk Events**

- Discrete event
- 2 key attributes
  - Probability
  - Impact(s)
- Threats & opportunities
- Multiple states
  - Current
  - Mitigated

#### **Project Risk Register**

	Risk				Current				Mitig	gation	
	Mapped	ID	Name		Probability	Schedule	Cost	Score 🤝	Enab	led Des	cription
т											
		R7	Risk of airpo	rt not being complete	Very High	Very High	High	25			
		R42	Risk of inabi	lity to hire craft to mai	Very High	High	Very High	25			
		R14	Risk of limite	ed in country infrastru	Very High	Very High	High	25			
		R9	Risk of delay	due to fab yard cons	Very High	Very High	High	25			
		R3	Risk of insuf	ficient in country skille	Very High	Low	Very High	25			
		R1	Risk of delay	post transportation	Very High	Very High	Very High	25		<b>V</b>	
		R37	Riks of majo	r dredging equipment	Very High	Very High	High	25			
		R39	Risk of work	stoppage due to cora	Very High	Medium	High	20			
		R36	Riks of theft	of materials (especiall	High	Very High	High	20		<b>v</b>	
		R38	Risk of chan	ge in law impacting c	High	Very High	Very High	20			
		R41	Risk of delay	in approvals of visas	High	Low	Very High	20			
		R46	Risk of plane	e crash with project cr	High	Very High	Negligible	20			
	<b>V</b>	R34	Risk of actua	I required resources e	Very High	High	Medium	20		<b>V</b>	
		R43	Risk of delay	s in establishing pion	High	High	Medium	16			
		R2	Risk of custo	oms delays	High	High	High	16			
		R5	Risk of pirate	es during FPSO sail fro	High	High	Medium	16		<b>v</b>	
		R44	Risk of Gove	rnmental agency dire	Very High	Medium	Low	15			
		R23	Risk of weat	her event	High	Medium	Low	12		<b>V</b>	
		R21	Risk of insuf	ficient Commissioning	High	Low	Medium	12			
		R45	Risk of delay	rs in releasing equipm	Low	Very High	High	10			
		R20	Risk of reject	tion and/or late appro	Low	Very High	High	10			
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# // Risk Register Calibration

#### One Size Doesn't Fit All

- # of categories
  - 5X5 is standard
- Define probability scale
  - Don't adopt HSE scale
- Calibrate impacts
  - Relative or absolute?
- Determine thresholds
  - Risk score is irrelevant...

### **Risk Register Calibration**

	Ţ Templa	te		Event Tem	olate Editor							
	Open Save File	5 3 Probability Rat		· · · · · · 9 0 t Ranges	9 	18 Thresholds	25 Calibrat	te				
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	Medium	>25%	3	6	9	12	15					
	Low	>10%	2	4	6	8	10					
	Very Low	<=10%	1	2	3	4	5					
Ri	sk Register Cu	istom Fields		Is East	alad							
•	Owner			IS LINK								
	Custom Field	1										
	Custom Field	2										
	Custom Field	3										
								-				
							OK					



### // Mapping Risk Events

Tying it all Together





### // Step 3: Risk Adjusted Schedules

**Running the Simulation** 

- Accounts for all reasonable combinations of risk & uncertainty
- Is true to the logic of the CPM schedule
- Critical path may jump
- Run enough iterations until results don't significantly vary

Sim	ulation								
	Number of Iterations								
	Complete Automatically Perform risk analysis until results converge to given accuracy.								
	Automatic Accuracy								
	Convergence Iterations 100 😜								
Sce	narios								
	Uncertainty Only (No Risk Events) Perform the risk analysis including only duration uncertainty.								
<b>v</b>	Uncertainty and Risk Events (No Mitigation) Perform the risk analysis including both uncertainty and pre- mitigated risk events.								
	Uncertainty and Risk Events (Mitigated, Excluding Overhead) Perform the risk analysis including both uncertainty and pre- mitigated risk events, but without the cost/schedule effort required for mitigation.								
	Uncertainty and Risk Events (Mitigated, Including Overhead) Perform the risk analysis including both uncertainty and pre- mitigated risk events, and including the cost/schedule effort required for mitigation.								
Inte	eraction								
<b>v</b>	Automatic Automatically run all of the risk analysis iterations using multiple CPU cores. (Fastest)								
	Interactive Automatically run risk analysis iterations and view the values changing during the execution. (Fast)								
	Diagnose Manually run each risk analysis iteration and view the values changing during execution. (Slow)								
Rep	peatability								
$\checkmark$	Use Fixed Seed								
	Seed Value								
Hie	rarchical Risk Models								
	Use Correlation to Overcome the Central Limit Theorem.								
	Correlation Frequency 50.00 % 🗧								
Cos	t/Schedule Integration								
	Account for cost of schedule risk impact								



# // Step 4: Risk Exposure

Histogram

- P-Dates
  - "I'm 50% confident I will finish on..."

#### Contingency

 "How much more/less time do I need to finish by...?"

#### Confidence Level

 "What chance do I have of hitting my finish date?"

#### − Risk Range Factor<sup>™</sup>

 Much better means of determining risk exposure





# // Step 4: Risk Drivers

Tornados

#### Risk Drivers

- High-risk activities
- Most impactful events

#### Traditional Reporting

% based

$$R = 1 - \frac{6 \cdot \sum d^2}{n(n^2 - 1)}$$

#### − Risk Contribution Factor<sup>™</sup>

- True measure of impact in duration & cost!
- Differentiates between uncertainty & risks





## // Step 5: Risk Reduction

Scenario Comparison

- Compare scenarios in a single workbook:
  - Turn on or off risks
  - Benefit of mitigation
  - Uncertainty vs. Risk Events
  - Schedule A vs. Schedule B
  - Impact of schedule delay on cost risk





### // Schedule Impact on Cost Risk



### // Developing Cost Risk Models Accounting for Schedule-Risk

Left Right Panel + Panel + Views	k All Gantt Chart Refresh Cost/Schedule Color Scheme + Overlay Activities	Finish Start Duratio	on Float Cost	Add to Risk Comparison	Configuration	Run Risk Analysis + Ad	Build Risk djusted Schedul Analysis	Create Scenario	e Unce D - Tem	ertainty Risk I pplate Temp Templates	Matrix Pub olate Pub	lish
» Id	Description Remaining Cost	Cost Uncertainty		🛟 Integrate Cost/Sci	hedule Risk Un	certainty						
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## More information:

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