Suncor Major Projects Group

Marrying Risk Register with Project Trending

AACE Calgary Chinook Chapter

RISK .06

A Practical Way to Forecast Cost Overruns

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In a recent survey, 6 of the 10 factors that were found to be significant for project success (in terms of time, cost & scope) were related to the adequacy of the risk management practices employed!

David Greenwood, PhD

Northumbria University

Newcastle-upon-Tyne, UK

Project	Budget (£millions)	Final Account (£millions)
Thames Barrier	23	461
Barbican Arts Centre	17	80
Natwest Tower	15	115
Humber Bridge	19	120
British Library	164	450
Sydney Opera House	2.5	87
BNFL Thorpe	300	2800
Trans-Alaska Pipeline	900	8,500
Channel Tunnel	4,000	11,000
Scottish Parliament	40	400

How About:

UE-1? Nova Joffre? LP-7 ? Suncor Millennium? Shell Upgrader? Husky? PetroCanada? Irving Oil ?

"RESPECT" Is the Key Word

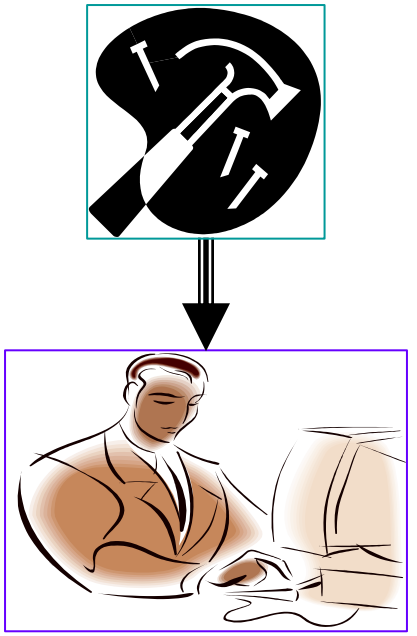
R	Risk Tracking and Management
E	Education and Enhancement
S	Standards and Benchmarking
P	People and Human Factors
E	Experiences and Lessons Learned
C	Change Controls and Management
T	Teamwork and Allies

Keynote Speaker, AACEi 49th Conference
Joe M. Koppelman
CEO, Primavera Systems

Migration from Tradition to Evolution

"In That Old Hammer and Nail Days"

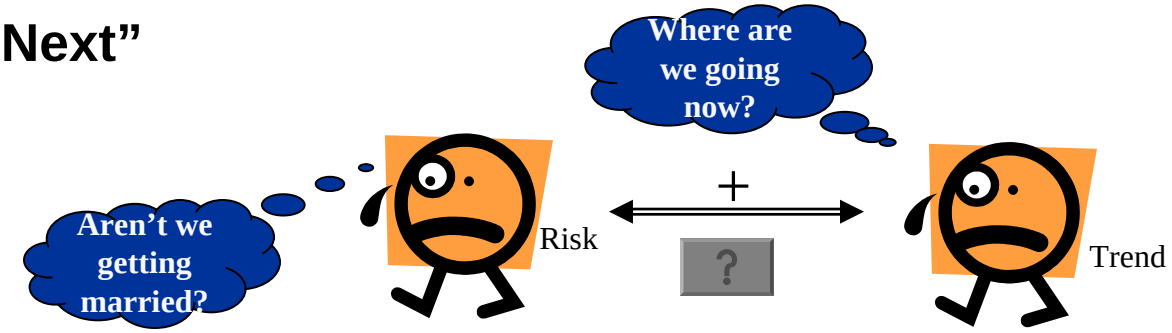
"Change Order" and "Trends" dominate Management of Change (MOC) Process



"When 32-Bit Computer Is Everywhere"

"Formal Risk Management is preferred with the help of Monte Carlo Simulation"

"What is the Next"



Prelude of The Tradition

Being "Singles"

- Project Risk Management is a practice independent of Project Cost Forecast via Trending process
- Project Trending process does not systematically capture Risk Response Action costs and / or time
- Project Risk Quantification is a one time deal using Monte Carlo simulation technique for the contingency

Potential Risks

- Costs to "mitigate" project risks are not timely and properly captured in the project estimate or forecast
- Inadequate funds to conduct rigorous project risk response actions due to "missed / omitted" risk budgets;
- Trending Process is not used effectively to capture "future cost" but used to record the "actual cost"

Proposed Marriage

- Project Risk Register and Project Trending Process
- The functions of Project Risk Management and Project Controls

Change Management by Trending

Trending

- Trend is a tool, a methodology, and a process to capture changes that are about to happen
- Project Trending provides an effective forewarning of potential changes and cost / schedule forecasts

Trend Log

- It serves as a discussion paper to present changes to higher management for alternatives or decision-makings
- It records the impact of additional cost and extra time required if the change is physically implemented

Figure 1: Simple Trend Log

Trend No.	Trend Description	Dated	Change Requester	$ Cost Impact	Trend Status	WBS / COA	Notes
1	Fnds increase	06-05	Civil Eng.	$500K	Pending	0110-02	Vessel sizes change
2	HDFE Pipe to CS	05-05	Process Eng.	$2.5M	Potential	0110-05	Design Pressure change

Trending Pitfalls – Tricks of the Trade

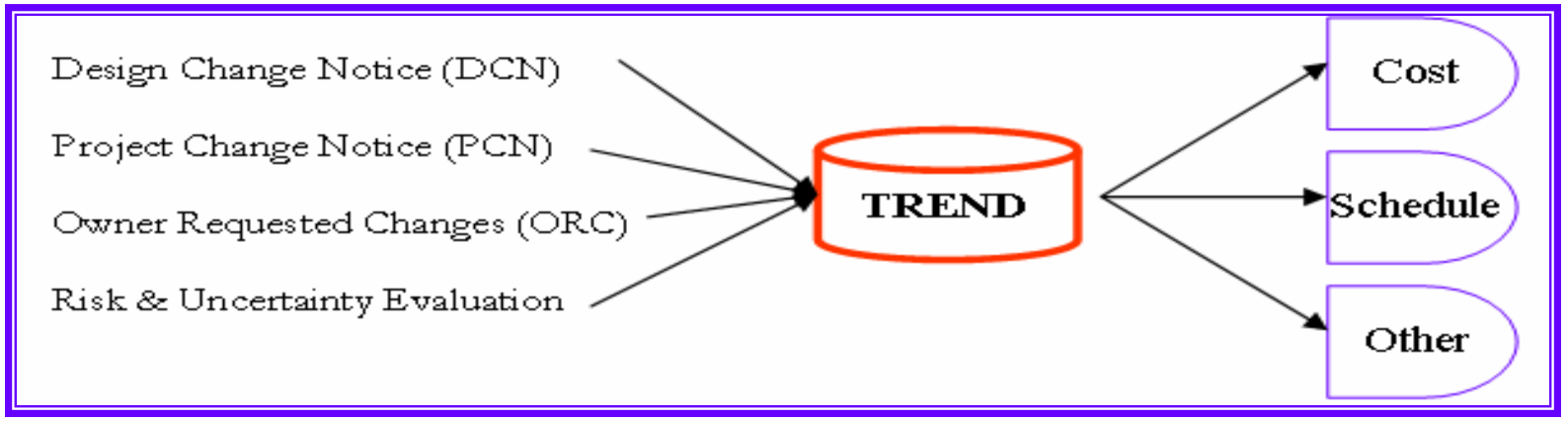
"Already Happened"

- Trends are used as a justification to explain for cost overruns
- Trends are used to capture what has happened & incurred
- Trends are used as "forgiveness" for errors and omissions etc.
- Trends are used to increase "budgets" instead of forecasts

"Decisions for Alternatives"

- It stays as a trend pending "further study" and "decisions"
- It evolves to a "major scope change" but is treated as a trend
- It can not support potential claims; lacking of detailed changes

Figure 2: Trend Input and Output



Compromised Trended Forecast

"Out, you are excluded !"

- FAC (Forecast at Completion) is regularly updated
- FAC entails only trended amounts approved by Project Mgr.
- FAC excludes pending and potential trends recorded in the log
- FAC discounts cost engineer's "gut feeling" towards changes

"More Holes, More Traps"

- Variance Analysis is not available as an input to FAC process
- Earned Value and Progress Measurements are not validated
- External Influential factors causing uncertainties not considered

Figure 3: Compromised Forecast at Completion

Major Accounts	Budget	Approved Trends	Pending Trends	Potential Trends	Risk Action Trends	Current Forecast	To-date Commited	To-date Incurred	To-date Expended	Deviation Variance	Earned Value
	A	B	C	D	E	F=A+B	G	H	I	J=H-A	K
Direct Labor	100,000			5,000		100,000					
Direct Materials	100,000	15,000				115,000					
Direct Subcontracts	100,000		20,000			100,000					
Direct Other	100,000				2,500	100,000					
Field Indirects	120,000			6,000		120,000					
H.O. Eng. & PM	104,000	10,000				114,000					
C&SU	49,920				3,500	49,920					
TOTAL	**673,920**	**25,000**	**20,000**	**11,000**	**6,000**	**698,920**	**0**	**0**	**0**	**0**	**0**

Risks and Risk Management

"Being Practiced"

- Risks are future events with potential "probability" of occurrence
- Risks have been identified and recorded in Risk Register
- Risks are ranked to assess their severity of impact to "goals"
- Risks are assigned with appropriate response actions & costs

"Playing Solo"

- The process is exercised, efficiently, independent of "others"
- Decisions made to "mitigate" risks are not passed on as trends
- Risks being accepted have no "contingency plans" for "what-if"

Figure 4: Project Risk Register

Risk Identification											
Risk Category	WBS Areas	Risk Description Symptoms and Root Causes			Risk Initiator	Date of Origin	Risk Recipient				
Initial Risk Ranking											
Probability (A): I - VI	Initial Impact Assessment (I - VI)				Consequence (B): I - VI	Priority I - III	Stability I or II	Initial Score	Risk Level	Cost Impact	
	EH&S	Cost	Schedule	Social							

Risk Assessment and Action Plan

"Find Big Rocks!"

- There are numerous risks in a project; where do we start?
- Risks are to be ranked for "probability and consequence"
- Pareto's Law:

Roughly 80% of your headaches are caused by just 20% of your problems !

"Action Costs Money"

- It costs you extra to make changes to avoid risks !
- It costs you extra to take actions to mitigate risks !
- It costs you extra to revise strategy to transfer risks !

Figure 5: Risk Evaluation Matrix

6	III	II	I	I	I	I
5	III	III	II	I	I	I
4	IV	III	III	II	I	I
3	IV	IV	III	III	II	I
2	IV	IV	IV	III	II	II
1	IV	IV	IV	IV	III	III
	1	2	3	4	5	6

Rocket Science – Monte Carlo

"A Big Deal!"

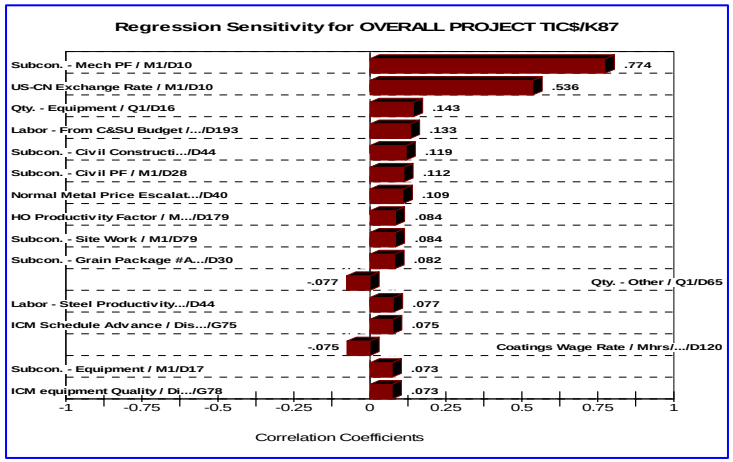
- "Without numbers, Risk is wholly a matter of Gut" !
- Certainty (Math) – Risk (Simulation) – Uncertainty (Regret)
- Murphy's Law:

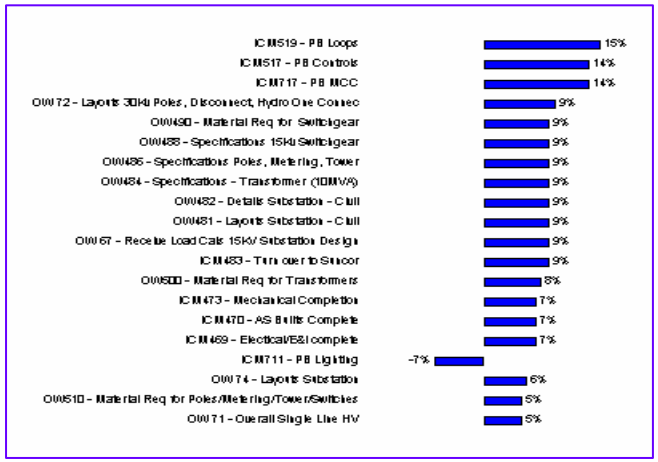
Things will go wrong when they are deemed to go wrong !

"Old concept, Modern use "

- It forewarns you what could go wrong and how likely !
- It alerts you to what impact it would be when things go wrong !
- Pareto's law marries Murphy's law: which 20% will go wrong !

Figure 6: Tornado Diagram





Risks to be Simulated Not Calculated

"Enough is Enough!"

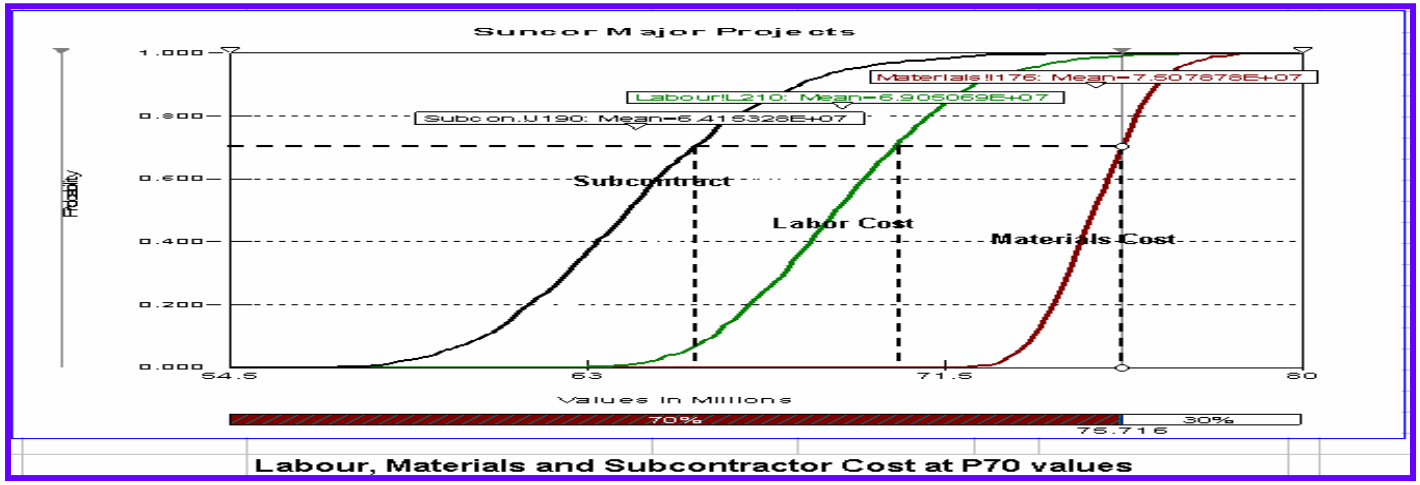
- Variables that will significantly impact your "bottom line" number
- Total Installed Cost (TIC) must be justifiable to IRR and ROCE
- Central Limit Theorem (in layman's words):

Too Many variables will nullify the true meanings of simulation !

Controversial "Contingency"

- Contingency amount is determined by Risk Tolerance Level
- An organization's Risk Tolerability drives TIC, not cost engineer
- Philosophical and definitive concept: Contingency is for Risks

Figure 7: Cumulative Distribution Function



Strong Views from Two Families

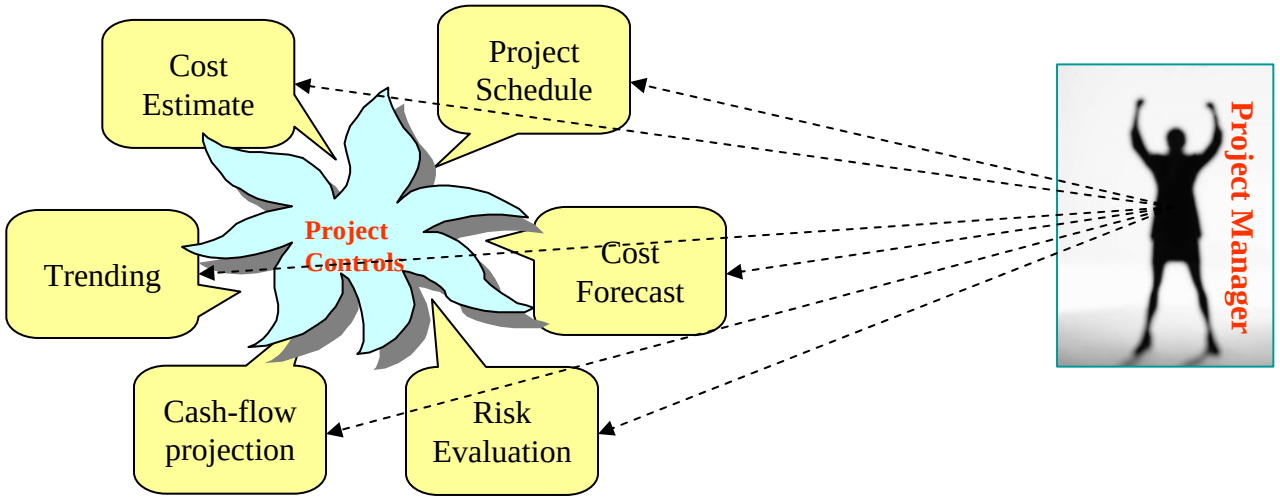
"Project Controls"

- The centre of Universe: we will control estimate and schedule
- We will generate "cost contingency" by running Monte Carlo
- We will trend changes to derive total project cost forecast

"Project Management"

- The centre of Power: we decide how much and by when
- We have the processes to determine how to run risk program
- We tell you what is a trend and how it is included in the forecast

Figure 8: Two Families' View



Marriage: Bride and Groom

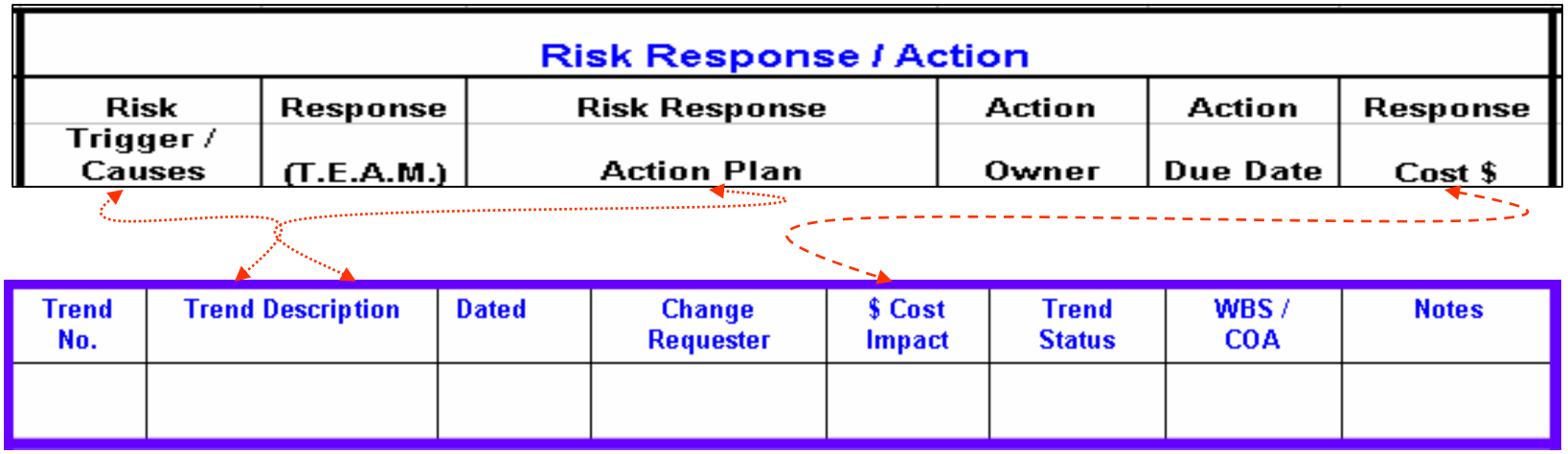
"Risky Groom"

- Risk Triggers & Action Details are available as input to trend
- Rough Order of Magnitude cost estimate (+/-50%) is done
- Why PRM? - Risks are contained before they are materialized

"Trendy Bride"

- Trend system set up to receive inputs from Risk Register
- Further sanctioning (+/-30%) by PM to authorize extra money
- A true "Cost Forecast" that reflects all changes made to-date

Figure 9: Sharing Commonalities



Post Marriage Discussions

What types of Risk go to the Trend Log?

- Risks with high probability of occurrence and intolerable impact must be handled with actions, that cost is significant enough as a trend

What happens if risks are not in the Trend Log?

- A wonderful execution plan may end up without adequate funds to support it, unless the AFE estimate has identified & included money.

When can I remove the risk from Risk Register?

- Performing cost and benefit analysis, the initial risk needs to be mitigated to a tolerable residual risk level before it shall be taken out.

How do I place Risk inputs into the Trend Log?

- Ideally Risk and Trend review meetings shall be scheduled together and the Risk and Trend Coordinators shall sit in both meetings.

Can a trend item become a Risk?

- Absolutely; any change to plan will trigger a risk occurrence

Measures to Enhance Marriage Life

Contingency Funds

- They are designed to support identified risk mitigation efforts
- They are identified as a result of Monte Carlo simulation
- They are used to effectively and efficiently handle “top risks”
- They are forecasted up and down following the shift of risks
- They help stabilize project forecast by offsetting “Trends”

Sensitivity Tables

- They make project team realize what are top rank risks
- They may direct on how contingency funds are allocated
- They provide a tool to measure the adequacy of contingency
- They identify problematic “variables” and place in Trend Log

Trend Log or Risk Register

- Place in Register if appropriate actions need to be detailed
- Place in Log if significant costs need to be included in forecast
- Place in both Log and Register if “big risks” need money to fix

Sour Marriage: Alarming Forecast

"Legitimate Trends"

- FAC only includes In-scope changes and risk containment costs
- FAC to include extra costs for Schedule acceleration (fixed end date)
- Scope Changes MUST be estimated to increase "the budget"

"Definitive Estimate"

- Perhaps, an IFC-based check cost estimate is necessary
- Perhaps, the original base-line is not realistic to start with
- Perhaps, a risk simulation for Forecast-to-Go is required

Figure 10: Total Cost Forecast

Major Accounts	Budget	Approved Trends	Pending Trends	Potential Trends	Schedule Trends	Risk Action Trends	Current Forecast
	A	B	C	D	X	E	F=A+B+C+D+E+X
Direct Labor	100,000			5,000	25,000		130,000
Direct Materials	100,000	15,000					115,000
Direct Subcontracts	100,000		20,000				120,000
Direct Other	100,000					2,500	102,500
Field Indirects	120,000			6,000			126,000
H.O. Eng. & PM	104,000	10,000			5,000		119,000
C&SU	49,920					3,500	53,420
TOTAL	**673,920**	**25,000**	**20,000**	**11,000**	**30,000**	**6,000**	**765,920**

A long Way to Go – Mindset

Sequential Order

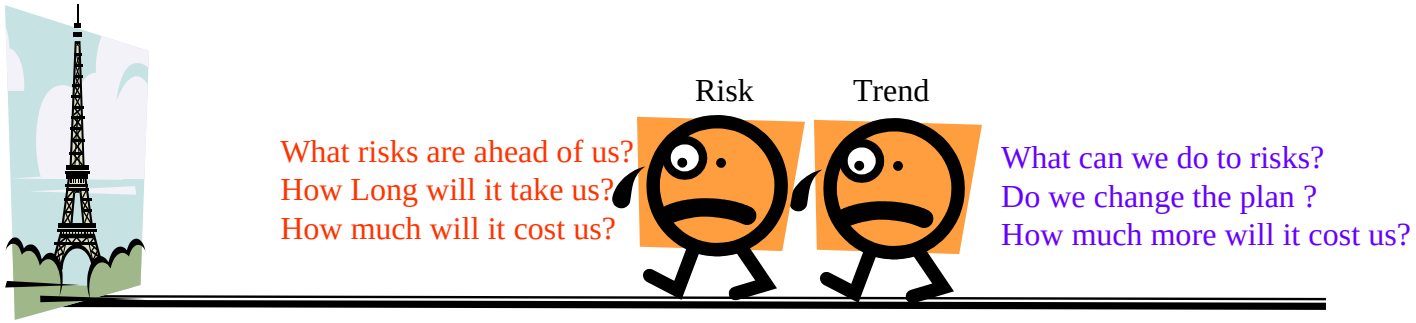
- (1) complete Risk Identification and Ranking (all hazards)
- (2) conduct Schedule Risk analysis (how likely to meet schedule)
- (3) conclude Cost Risk analysis (total $TIC as-built)

Integration

- seamlessly combine schedule & cost risk analysis in **1** exercise
- input risk data into trend log and include into 1 cost forecast

Processes

- Monte Carlo Simulation, Benchmarking and Earned Value
- Active Risk Management (ARM), PRISM Risk & Cost Manager
- Risk-savvy Project Controls cost engineer & schedule planner



Summary and Conclusion

Look Ahead into Future

Risk Management deals with future uncertainty;
Trending Systems handle changes for the future;

Reliance on the ability to Predict

Both Risk Management and Trending System are about Future Predictability of project outcome;

Accurate, Defensible Forecast

Risk Management provides a scientific way to better predict the Forecast At Completion (FAC).

Questions and Answers