

# RISK: INTENTIONAL INTERACTION WITH UNCERTAINTY

*Presented at the  
International Cost Estimating and Analysis Association (ICEAA)  
Professional and Training Workshop*

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# PRESENTERS

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## Ray Britt

- Raymond Britt is currently a Business Strategy Analyst Senior Manager at Booz Allen Hamilton. He has a myriad of experiences over the years in Project Management, Operational Planning, Military Operations, Nuclear Engineering, Data Analytics and Risk Management. He has also worked as an Analyst for the Office of Naval Intelligence and a Director of Production Development at Ted Britt Ford Automotive Group. As a senior Associate at Booz Allen Hamilton, he leads a team of data analysts to help solve today's most pressing problems.

## Kai Lemay

- Kai Lemay is an experienced Consultant, Project Manager and Product Manager. He has over a decade of experience supporting clients with management and decision analysis in oil and gas, aerospace, defense and construction. Kai graduated from the University of Central Florida with a degree in Business Administration and received his master's degree in Systems Engineering from the George Washington University. Presently he leads a team of analysts who help clients with project management and decision analysis to better manage their large projects.

# AGENDA

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- Risk Management
- Compliance Exercise
- Integrated Management Tool
- Moving from Compliance to Management Tool



# IS RISK MANAGEMENT IS A COMPLIANCE EXERCISE OR A MANAGEMENT TOOL?

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- The focus for this brief will be more specific to DoD programs, however many commercial organizations could benefit from the themes outlined in this presentation.
- There is a perception that Risk Management is difficult, overly sophisticated, and time consuming, this could not be further from the truth. However, in our project experience the DoD uses risk management on major programs as more of a compliance exercise than a way to effectively manage program risk and maximize success on a program.
- This is not intended to be negative or to state that DoD programs are not doing what is mandated, but due to this perception, programs are losing a huge opportunity to maximize program success by analyzing and mitigating risk **before** it happens.
- This brief explores the **current use of risk management** and **why programs continue the pattern of compliance** versus thorough management of their risks, and **recommends ways that programs can start using risk management as a tool to increase the probability of program success**

A smart man once said: *“its not the big risk on the risk register that hurts a program, it’s the 3 or 4 little risks at the bottom that happen all at once that cause the most damage”*

# RISK MANAGEMENT OVERVIEW

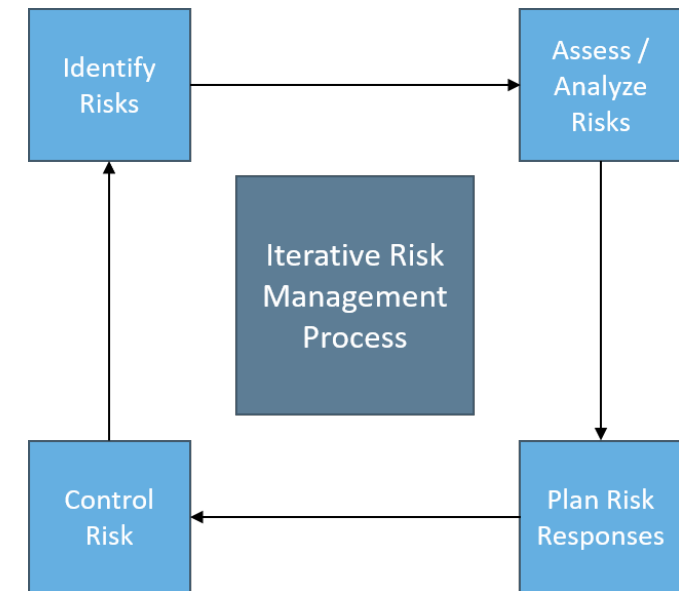
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## ***Before we get started lets cover a few definitions...***

- Risk – a known unknown
- Uncertainty – an unknown unknown
- Risk Management – an organized, systematic process that efficiently identifies risks, prioritizes them, develops and documents contingency plans and mitigation strategies, and provides decision-makers with the necessary information at the appropriate time to make sound decisions

## ***More specifically risk is....***

- A potential future event that if prevented would also prevent a consequence from occurring. Any future event will include:
  - A likelihood of occurrence
  - A consequence on a program if it occurs
  - Cost, Schedule and Performance parameters, which allow risks to be considered in relation to their impact on different program areas



# WHAT ARE POTENTIAL SOURCES OF RISK?

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When we talk about risk, we have to think about all of the different things that can affect a program, below is a list of potential factors that can impact a program (this isn't an all inclusive list but it starts to describe all the different items a program should be thinking about as a part of the risk management plan):

- Outside Threats
- Requirements
- Technical Baseline
- Test and Evaluation
- Technology
- Logistics
- Production/Facilities
- Concurrency
- Industrial Capability
- Cost
- Management
- Schedule
- Budget
- Departure from Specification
- Resources



# LETS LOOK DEEPER...WHAT IS PROGRAM RISK?

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**Program Risk** as defined by the DoD and Navy:

- “Risk is a measure of **future uncertainties** in achieving program performance goals and objectives within defined **cost, schedule, and performance** constraints.” - *Risk Management Guide for DoD Acquisition (2006)*
- “Risk is the **potential** for mishaps or other adverse variation in the **cost, schedule or performance** of a program or its products.” - *The Naval SYSCOM Risk Management Policy (2008)*

The definitions for risk are pretty similar no matter the program type or size, however the questions that should be asked when starting a risk management program are critical. When thinking about risk management on any project these questions should be at the forefront:

- How do the program define risk?
- How does the program conduct risk management?
- How does risk affect a program?
- How does the program analyze, manage and mitigate risk impacts?

*Why do programs only list out a few risks in the register? Why do programs only look at a quick qualitative analysis and not dive deep into how risks impact the program as a whole?  
And why are mitigation actions overly simple and incomplete?*

# COMPLIANCE EXERCISE?

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The graphic below describes the Risk Management process per PMI:



- Even though the Navy's definition of Program Risk is pretty straight forward on the analysis programs need to complete, most programs only move through the first three circles (boxed in red). Very few programs complete the full process, usually completing the last half of the process with incomplete information or incomplete analysis
- By completing a risk management plan and going through the process, this checks the risk management "compliance" box as required by DoD and Navy program requirements but does not address risk as defined by the larger organization
- So why do programs only "check the box"? Lets dive deeper into it...



# RISK MANAGEMENT AS A COMPLIANCE EXERCISE

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*So how does the process become more compliance and less analysis?* The view that risk management is difficult and time consuming leads programs to either:

Go through the motions to ensure compliance to Program Management processes when audited

Or

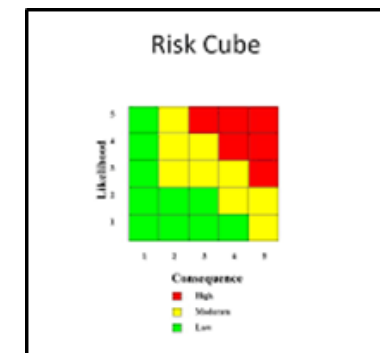
Too “busy” to conduct sound risk management process and analysis

There are four areas that we’ve found can help identify if a program is conducting Risk Management compliance:

1. Risk Register Volume (High impact – low quantity)
2. Absence of tangible analysis and impact
3. Incomplete mitigation plans
4. Over reliance on point estimates

# LOW VOLUME & HIGH IMPACT - LIMITING RISK REGISTER DEVELOPMENT

- There is no right number of risks on program, however the risk register should have enough risks to cover the size and complexity of the program. For example a multibillion dollar weapons platform should probably have more than 13 risks in the register (yes, this is a real program)
- Following the risk management process the first step is to list out all the risks on a program. Unfortunately many programs limit risk register development and only list out a few high level risks on the program. These risks tend to be vague, and are likely to involve multiple organizations while impacting multiple parts of the project
- To make matters worse, the low volume high impact risks typically have only a subjective likelihood and consequence assignment made via the risk cube. This leaves the impact as a numerical score that does not map a risk to where it impacts the project or to how cost, schedule or performance is impacted as noted in the DoD's definition of a risk
- This low volume high impact approach is consistently used because listing all the risks that could impact the project is seen as labor intensive. Keeping risks vague or general is seen as having risks that encompass greater impact and are therefore easier to mitigate – this is a fallacy that makes analysis and mitigation extremely difficult



# ABSENCE OF TANGIBLE ANALYSIS AND IMPACT

- Using only the risk cube for analysis will lead to an analysis that is only qualitative and incomplete
- If the program does not have a risk register with risks mapped to the project (with cost, schedule or performance impacts) and does not conduct a quantitative analysis, but has a fully filled out mitigation plan and strategy; red flags should be raised
- Many a program will fill out the register only to go straight to the mitigation without conducting any kind of analysis on the risks that are impacting the program. This can be detrimental to the program in multiple ways:
  - Underestimating/overestimating the impact of the risk
  - Misunderstanding where and how the risk impacts the project (i.e. critical path, resource impacts, cost growth, delivery milestones, etc.)
  - Improper ranking of the risk for mitigation (just because the risk cube says is the top risk doesn't mean it's the top risk on the project – very low threat risks can have huge consequences)

	5	10	15	20	25
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5
	Consequence				

Completing only the risk cube leads to over simplified Risks and incomplete Risk Mitigation Plans

# INCOMPLETE MITIGATION PLANS

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The previous two issues (Risk register development and risk analysis) are the main two contributors to an incomplete mitigation plan:

- The impact of limiting the number of risks recorded and the subsequent lack of quantitative analysis results in an incomplete risk mitigation plan. There are simply too few risks to capture the true risk profile of the program.
- Many risks are too high level and have subjective impacts. Many mitigation plans created only reflect **qualitative** information (i.e. feelings, subjective judgements) vice **quantitative** information (i.e. data based, numbers based, model based).



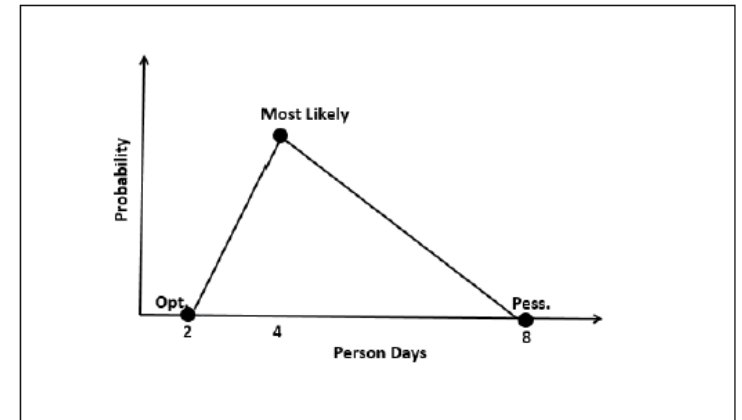
# OVER RELIANCE ON POINT ESTIMATES

Point estimates are used by slightly more mature programs, the most common being 3 point estimates. There are different formulas and methods of calculating point estimates but one of the most common is below:

- Optimistic (cO)
- Most Likely (cM)
- Pessimistic (cP)

- Triangular Distribution  
 $cE = (cO + cM + cP) / 3$
- Beta Distribution  
 $cE = (cO + 4cM + cP) / 6$

*\*this formula can be used for cost or schedule estimates*



Immature programs rely only on point estimate to capture risk impacts and will use one range to calculate the estimate for the entirety of the program. This is a step in the right direction, however the result of the analysis will only capture one output and will not allow for impact analysis of individual risks or mitigation plans that are create from those analyses. More commonly a three point estimate is used to capture only uncertainty, meaning the unknown unknowns of a project,

# INTEGRATED MANAGEMENT TOOL

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As a program moves away from conducting risk management as a compliance activity, and transitions to using Risk Management as strategic tool, Risk management then becomes a fundamental tool enabling decision makers to manage their programs with dynamic transparency and clarity. Programs that embrace Risk Management as an integrated tool use the following techniques to fully capture and manage risk on their program:

1. Risk Volume (Unknown impact – high quantity)
2. Variety of information and gathering methods
3. Adjusting Subject Matter Expert Bias
4. Integrated analysis
5. Analytic based Mitigation Plans

## RISK VOLUME (UNKNOWN IMPACT – HIGH QUANTITY)

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- Risks should be identified and managed throughout the entire program lifecycle at the earliest stages of program planning, continuing throughout the lifecycle of the program.
- At the start of the program, the risk gathering process should be broad. All risks should be gathered even if the impact is unknown or the risk is thought to be small or insignificant. This process should be conducted throughout the lifecycle of the program and will likely result in a large number of risks.
- Risks can follow the qualitative to quantitative process, however the focus should be put on quantifying and assigning risk impacts to the project and cost/schedule/performance impacts.
- Once the quantification is done, only then can analyses be conducted so that risks can be mitigated, retired or accepted.



*The takeaway is the risk register should not have a maximum number of risks in it, **in fact, it should feel like there are too many risks at the start of the program***

# VARIETY OF INFORMATION GATHERING METHODS

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The success of the risk gathering process will depend heavily on the time spent completing the risk register as well as the techniques used to gather information.

There is no right way to gather data, however some methods work better than others depending on the team make up and time to complete. Below are a couple of different ways Risks are gathered:

- Interviews (Delphi technique)
- Group sessions
- Surveys
- Analysis of similar projects



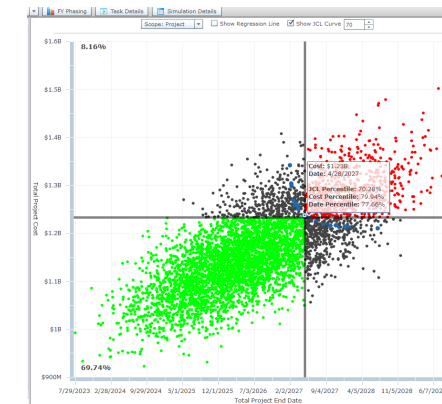
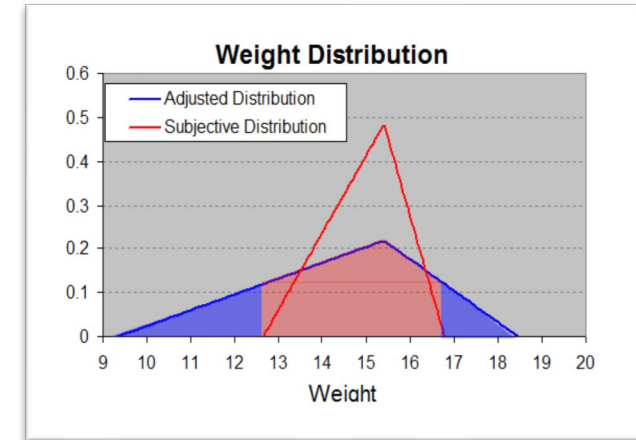
*The most important factor in gathering information is that all parties are participating and do not feel threatened to share information*



# ADJUSTING SUBJECT MATTER EXPERT BIAS

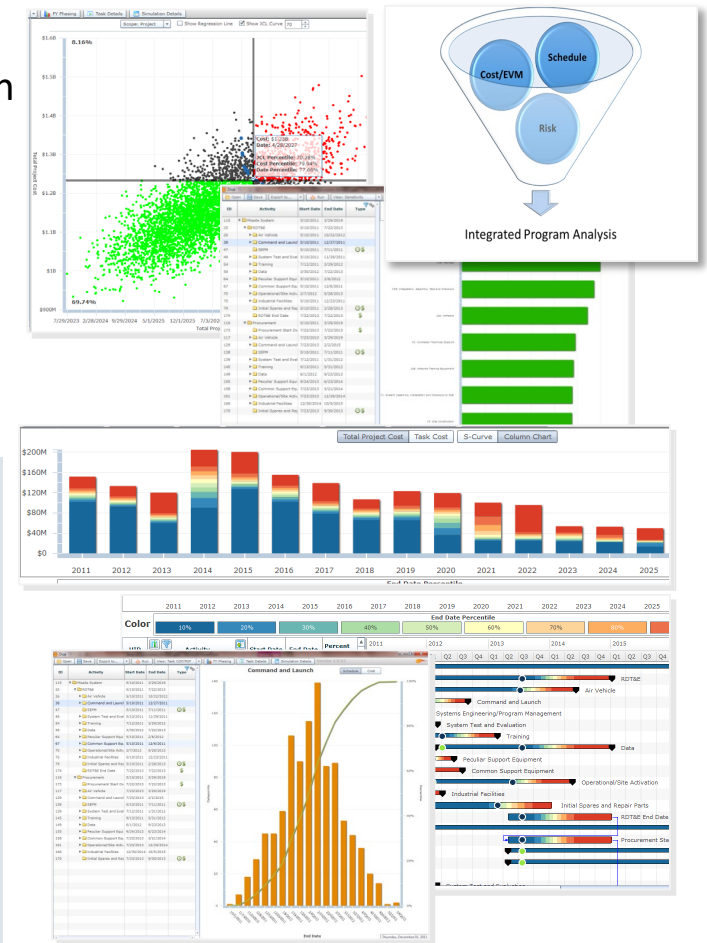
An important step in the interview, risk assignment, and risk analysis process is to adjust SME bias when applying distributions to risk models

- SME's tend to underestimate the amount of uncertainty on risk and uncertainty impacts (in other words they tend to have ranges that are too narrow)
- This can lead to uncertainty being underestimated
- Original SME Min and Max only captures 70% of the true range of possibilities
- Typically the Min and Max would be set at 15/85 or 20/80
- Tools can be used to adjust subjective bounds –Example Below:
  - Point estimates provide PMs a good starting point for program budget and length, but add little actionable value once a program is in execution
  - Monte Carlo simulation aggregates program information to understand all potential program costs / length
  - Historically, Monte Carlo has been a very time intensive and expensive analytic method however new tools have significantly lowered the barrier for entry



# INTEGRATED ANALYSIS

- Conducting integrated schedule, cost or integrated risk analysis will allow the project to understand how cost and schedule growth are correlated, what risks are on or impact the critical path, budgets vs risk adjusted costs, schedule criticality, mitigation and what-if analysis
- Schedule risk analysis, Cost risk analysis, Integrated cost and schedule risk analysis, Budget/Management Reserve Planning, and/or Liquidated Damage/Cost Penalty Exposure further reinforce making data driven decisions and will allow the team to model potential future actions.



*Suppose you want to estimate the cost of operating a ship for the next year and you want to be 80% confident that your organization's budget is sufficient to cover all the costs associated with that platform. You decide to build a Monte Carlo model based on historical data. The steps to building this model are:*

- *Decide on all inputs to the model*
- *Calculate point (most likely) estimates for each input*
- *Calculate risk or uncertainty distributions for appropriate inputs*
- *Combine point estimates and distributions in model for estimate of total cost*
- *Run Monte Carlo simulation to get risk-adjusted cost and 80% confidence level*

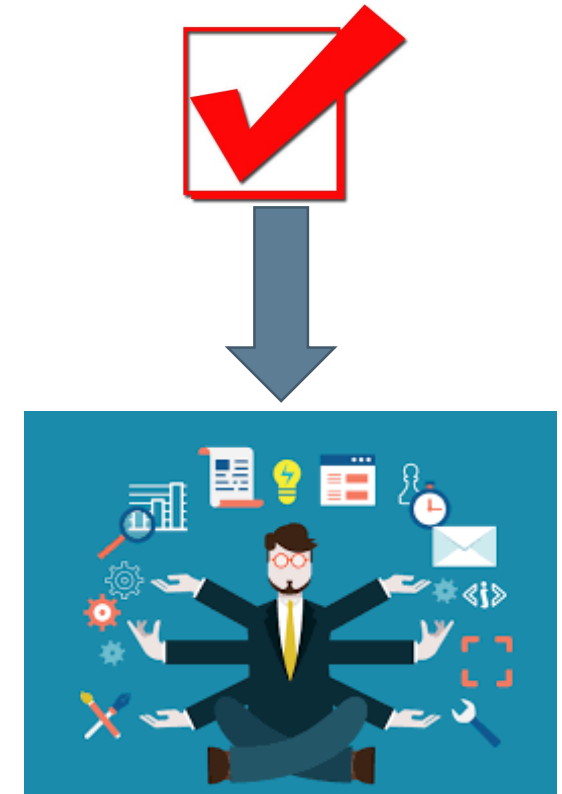
# ANALYTIC BASED MITIGATION PLANS

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- Quantitative Methods can provide insight into the impacts of changes in cost, schedule, and performance to give you a better understanding of how risks will impact the program from a cost, schedule and performance perspective.
- By using an analytical root cause analysis, program risks can be assessed and mitigation strategies can be developed to manage these risks during each acquisition phase:
  - Early identification of risks is key
  - Modeling and Simulation, and Rapid Prototyping can be used to reduce risks
  - Identification of perceived risks in proposals aids in early Risk Identification
  - Establish a realistic schedule and funding baseline as early as possible that includes not only the acceptable level of risk, but adequate funding and schedule margins
- With a super mature risk program-- you can do: Predictive Analysis - a set of techniques and methodologies used to analyze historical data and trends in order to predict future events. Some of the techniques for predictive analysis include:
  - *Regression Analysis*
  - *Time Series Modeling*
  - *Classification*
  - *Survival Analysis*
  - *Simulation Modeling*
  - *Joint Confidence Level*
- The ability to understand what those outcomes are in tangible impacts allow for future development of mitigation plans and/or planning and allocation of contingency/management reserve to address risk impacts.

# MOVING FROM COMPLIANCE TO MANAGEMENT TOOL

- If a program is doing at least the level of compliance based risk management they are already an excellent candidate to shift to using it as a management tool
- If in doubt where to start, start with the risk register and go from there
- Don't try and assess all the risks in a single meeting, work towards multiple short follow ups
- Don't get overly focused on sophisticated analyses initially. Use the KISS principal, start slow with easy to understand analyses (i.e. start with schedule risk analysis before doing integrated cost and schedule risk analysis)
- Beyond the aforementioned steps to using risk management as a management tool, the critical success factors to a successful implementation are:
  - All team members and/or stakeholders on board to work through the process
  - A willingness to try a different way of managing
  - An organization that values data driven decision making



*Risk mitigation plans that utilize data to form them are easier to defend and programs that use data to make decisions have a much easier time defending requests for resources, budget and/or schedule*

# QUESTIONS