LEVERAGING NETRISK & GPM FOR PROJECT RISK MANAGEMENT

FRANCISCO CRUZ, PE, RMP
DANE MCBAIN, PMP, LEED AP
PMA can leverage GPM/NetRisk to enhance project management and planning through PMA’s risk expertise.
Changed back-slash to "and"
Sergio, 1/8/2015
• The Case for Project Risk Analysis
• Leveraging PMA Expertise in Risk Management
• Case Study: NetRisk Demonstration
• What is new in NetRisk (Cost Risk Analysis Module)
• Benefits of Key Features
• Take-Away
Add space after bullets

Sergio, 1/8/2015
Terminology:

**Risk Management** – Soup to nuts strategy for identifying and controlling project or program risk.

```
- Risk Identification
- Risk Quantification
- Risk Response Planning
- Risk Monitoring & Control
- Review Process
- Risk Management Planning
```

**Project Communication**
**The Case for Project Risk Analysis**

**What are the three most common causes of cost overruns?**

- Material Price Escalation: 60%
- Poorly Defined Scope: 55%
- Contractual Disputes: 40%
- Time Delay: 36%
- Design Creep: 32%
- Achieving Productivities: 19%
- Lack of Approvals: 6%
- Weather: 4%
- Industrial Relations: 2%
- Others: 26%

**What are the three most common causes of delays?**

- Poorly Defined Scope: 57%
- Design Creep: 57%
- Lack of Approvals: 36%
- Contractual Disputes: 34%
- Weather: 21%
- Time Delay: 17%
- Achieving Productivities: 15%
- Material Price Escalation: 13%
- Commissioning Process: 2%
- Others: 19%

* KPMG 2008 Global Construction Survey

**According to the Bent Flyvbjerg’s Study on Large Projects,**

- 9 out of 10 projects have cost overrun;
- Overrun is found across the 20 nations and five continents.
- Overrun is constant for the 70-year period covered by the study; cost estimates have not improved over time.
The Case for Project Risk Analysis

What is the current performance in the construction industry?

Did you have underperforming projects?

- Yes 77%
- No 23%

Main causes of underperforming projects:

- Project delays: 51%
- Poor estimating practices: 50%
- Failed risk management processes: 47%
- Poor subcontractor performance: 37%
- Design errors and omissions: 36%
- Lack of available resources: 20%
- Change in project management team: 17%
- Poor client relations: 11%

* KPMG Global Construction Survey 2013
Consider the following simple 2-activity schedule:

Start → Activity A (12 weeks) → Activity B (10 weeks) → Finish
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Sergio, 1/8/2015

Relocated so that subsequent slides can match better
Sergio, 1/8/2015
Deterministic Schedule

- Start
- Activity A (12 weeks)
  - % critical = 100%
- Activity B (10 weeks)
  - % critical = 0%
- Finish
  - Project always to finish in 12 weeks
| 4 | Relocated to match previous slide  
|   | Sergio, 1/8/2015 |

| 22 | Unbold  
|    | Sergio, 1/8/2015 |
Probabilistic Schedule

Activity B has much more variability to the pessimistic side due to inherent risks of its work.
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Sergio, 1/8/2015
Probabilistic Schedule

% critical = 63%

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<thead>
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<th>PESS</th>
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<td>10</td>
<td>12</td>
<td>16</td>
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</table>

- Activity A (12 weeks)
  - P10: 11.3 weeks
  - P50: 13.1 weeks
  - P90: 15 weeks

% critical = 37%

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<td>8</td>
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<td>18</td>
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- Activity B (10 weeks)
- Finish
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Sergerio, 1/8/2015

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Sergerio, 1/8/2015
### The New Normal in Project Management

#### Growth of Probabilistic Modeling

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1947</td>
<td>Monte Carlo Simulation Invented</td>
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<tr>
<td></td>
<td>Innovated concept of random sampling</td>
</tr>
<tr>
<td>1958</td>
<td>PERT</td>
</tr>
<tr>
<td></td>
<td>Introduced alternatives into project planning</td>
</tr>
<tr>
<td>1991</td>
<td>Monte Carlo Risk Analysis®</td>
</tr>
<tr>
<td></td>
<td>PCs and software allowed proliferation</td>
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<tr>
<td>2013</td>
<td>NetRisk®</td>
</tr>
<tr>
<td></td>
<td>Introduced risk to project planning</td>
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</tbody>
</table>
Risk Assessment process through probabilistic modeling is the next step in Project Management
The New Normal in Project Management

Risk Assessment process through probabilistic modeling is the next step in Project Management

• Brings together and aligns stakeholders
Risk Assessment process through probabilistic modeling is the next step in Project Management

- Brings together and aligns stakeholders
- Vets and improves project scope, schedule and estimate
Risk Assessment process through stochastic modeling is the next step in Project Management.

- Brings together and aligns stakeholders
- Vets and improves project scope, schedule and estimate
- Promotes recognition and transparency in project challenges
Risk Assessment process through probabilistic modeling is the next step in Project Management

- Brings together and aligns stakeholders
- Vets and improves project scope, schedule and estimate
- Promotes recognition and transparency in project challenges
- Risk mitigation reduces potential impacts
Risk Assessment process through probabilistic modeling is the next step in Project Management

- Brings together and aligns stakeholders
- Vets and improves project scope, schedule and estimate
- Promotes recognition and transparency in project challenges
- Risk mitigation reduces potential impacts
- Evaluates feasibility of targets
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PMA Risk Experience

20+ Years

250+ Projects

20+ Countries

$50B+ Project Value
WHEN ARE RISK ANALYSES PERFORMED?

Contractor Perspective – Project Development & Execution

1. Preliminary Design: As necessary to support bid
2. Detailed Design: Usually
3. Procurement / Fabrication: As Needed
4. Installation / Construction: As Needed
5. Start-Up: As Needed
Terminology

- **Risk Assessment** – A subset of Risk Management, involves a single round of risk management planning, identification, scoring, quantification, reporting and mitigation, planning.
PMA’s Risk Assessment Approach

Port Authority of NY & NJ

Qualitative Assessment
- Critical & “Risk-sensitive” sequences
- Project Risks & Uncertainty

Schedule
- Identify
- Review
- Prioritize

Cost
- Identify
- Prioritize

Quantitative Assessment
- Model
- Range
- OPRA™ NetRisk™
- @Risk™ or Crystal Ball

Summary Sequences, Probabilistic Branching
- Develop Ranges for Variables: Scope, Price, Productivity, & Duration
- Durations of Critical Activities

Estimate Issues, Possible Risks & Response Plans
- Cost Breakdown, Variables, & Distributions
Typical Schedule / Cost Risk Assessment Process

1. **Project Schedule/Estimate Review:**
   - Need a Valid Schedule & Pro Forma

2. **Prepare Schedule/Cost Risk Model(s):**
   - Acceptable Schedule
   - Acceptable Model

3. **Perform Simulations; Interpret Results:**
   - Results

4. **Develop Model:**
   - Schedule/Estimate Review
   - Risk Info
   - Determine Ranges

5. **Run Simulation:**
   - "What-If" Analysis
   - Summarize Results

**Project Scope**
- PEP, Dwgs./Specs.
- Project Schedule
- Project Estimate

**Optional**
PMA’s Risk Assessment Approach

- Obtain / define deterministic schedule / estimate
- Critique schedule / estimate basis
  - Project calendar
  - Describes entire project scope
  - Reasonableness of critical path
  - Technical integrity
  - Resource assumptions & restrictions
- Should not proceed without valid schedule / estimate
- Schedule remediation by PMA is an option
Would be nice to show all 6 parts of the process as a reference

Sergio, 1/8/2015
Identify possible risks through discussions with knowledgeable project participants

Use appropriate risk identification techniques

Define critical, near-critical and risk-sensitive sequences in deterministic schedule

This information can be captured in a risk register
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PMA's Risk Assessment Approach

- Develop summary schedule from deterministic project schedule
  - Optimize use of finish-to-start relationships; avoid use of constraints; convert lags into activities
  - 50 to 250 activities
  - Concentrate on critical, near-critical and risk-sensitive sequences
- NetPoint® is ideal for summary plan unless otherwise specified by our clients
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Sergio, 1/8/2015

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Sergio, 1/8/2015
PMA’s Risk Assessment Approach

- For each activity in summary schedule, develop range of activity duration variability from past experiences:
  - Optimistic / Most Likely / Pessimistic
- Risks are often modeled separately as either discrete events or percentage impacts
- Seek input from many; try to avoid thinking too conservative on ranges
- However, avoid “Hollywood disaster movie” scenarios

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PMA’s Risk Assessment Approach

- Perform “Monte Carlo” – type simulation
- Sampling distributions assigned to activities are at the discretion of the analyst:
- Do the results make sense?
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• Prepare the right output:
  – Probability of key milestone dates and costs
    • Cumulative distribution curves
    • P10, P50, P90 dates / costs
  – Statistical information:
    • What is critical: Criticality Index, End Node Diagram
    • What influences the model: Schedule / Cost Sensitivity Index, Cruciality Index

• Discuss ways to minimize schedule / cost risks to project
  – Prioritize using risk analysis results
  – Propose follow-up mitigation sessions if-needed
Formatting matched to previous slide
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The project schedule deterministic date of 16-Sep-14 is in the 24th percentile of the simulation results distribution (including weather effects).
Tornado Diagram – Risks

BBNCP Risk Tornado Chart
Duration Sensitivity

- RD11 - FHWA Design Exception for substandard geometry not received by Q2, 2013: 46%
- REN4 - NY Environmental permits not received by Q4'12: 41%
- RD9 - Cash Collection is required in toll Lanes: 40%
- RC20 - Restricted Work Hours may delay construction: 36%
- RD2 - Procurement Process will take longer than 8 months therefore D/B contract will not ... 26%
- RC23 - Modified Toll Plaza collection not accepted for Toll Plaza delaying Traffic: 15%
- RD3 - Program not fully defined by Q1, 2012: 14%
- RC14 - Relocation of Known/Unknown Utilities may cause cost and schedule overruns: 12%
- RD1 - Design Package for Design Build will not be completed in Q2, 2013: 7%
- RRW7 - ULURP process will affect property acquisition in NY: 4%
In lieu of an unhelpful table of activities, a graphical representation of the activities most likely to influence project completion is provided.
NetRisk: Embodiment of GPM Risk

- Risk Manager – Consolidated Interface for All Risk Management Functionality
- Qualitative Risk Analysis
  - Interactive Risk Register
  - Probability & Impact Matrix
  - Risk Breakdown Structure
- Quantitative Risk Analysis
  - Duration Sampling, Floating, and Pacing
  - Prime Risks
  - Sensitivity Analysis
  - Scenario Modeling (Easy Comparison of Different Scenarios)
Do you know what we mean by 'visual'? 
Sergio, 1/8/2015
Pharmaceutical Project
Project Phoenix
Comparing Results

What Do Pre and Post-Treatment Results have in Common?

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<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<td><strong>Pre-Treatment Results</strong></td>
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<tr>
<td>Calendar Days</td>
<td>3/29</td>
<td>25</td>
<td>4/22</td>
<td>35</td>
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<td>Adjusted Schedule w/ Duration Uncertainty</td>
<td>4/22</td>
<td>60</td>
<td>5/27</td>
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<td>Pre-Mitigated Overall Project Over Run</td>
<td>5/8</td>
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<td><strong>Post-Treatment Results</strong></td>
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<tr>
<td>Calendar Days</td>
<td>3/29</td>
<td>25</td>
<td>4/22</td>
<td>15</td>
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<td>Adjusted Schedule w/ Duration Uncertainty</td>
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<td>5/7</td>
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<td>Pre-Mitigated Overall Project Over Run</td>
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What’s New in NetRisk? Cost Module
What’s New in NetRisk? Cost Module

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<th>Name</th>
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<td>Equipment (Process, Building &amp; Lab)</td>
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<td>Forward Escalation</td>
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<td>Temporary Facilities</td>
<td>$ Triangular [390,402,446]</td>
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</table>

**Cost Object Properties**

- **Name**: Affiliate Staff
- **Apply**: Time-neutral Cost (NC)

**Cost Distribution**

- **Allocation**: Uniform
- **Shape**: Triangular
- **Min**: 2912
- **Mode**: 3002
- **Max**: 3232

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What's New in NetRisk? Cost Module

NetRisk Manager - Risk Register

- Viewing: Risks
- Cost Objects assigned to "RSK01"

- S.
  - ID
  - Description
  - RSK01: Complex work and limited space could reduce productivity
  - RSK02: Lack of local resources from Pharma could impact GC schedule
  - RSK03: Potential of damaging validated utilities, which could delay...
  - RSK04: Filling equipment installation is complex, which could lead to...
  - RSK05: Potential rework to due limited space for construction
  - RSK06: Lack of utility capacity for equipment installation could impa...
  - RSK07: WW Doscharge Permit may take longer than expected
  - RSK08: Procurement process may take longer than 2 month

- Group Name:
- Likelihood: 50

- Impact Ranging
  - Shape: Triangular
  - % Variance
  - Min: 5.00
  - Mode: 10.00
  - Max: 25.00

- Cost Object Impact Parameters

- Create Group
- Modify...
- Ungroup

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What’s New in NetRisk? Cost Module
What’s New in NetRisk? Cost Module

NetRisk Manager - Standalone Cost

- **Name:** Affiliate Staff
- **Cost Distribution:** $ Triangular [2912, 3002, 3232]
- **Cost Distribution:** $ Triangular [120, 124, 137]
- **Cost Distribution:** $ Triangular [717, 739, 821]
- **Cost Distribution:** $ Triangular [2599, 2679, 2974]
- **Cost Distribution:** $ Triangular [7673, 7910, 8780]
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- **Cost Distribution:** $ Triangular [135, 140, 155]
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**Cost Distribution**
- **Allocation:** Uniform
- **Shape:** Triangular
- **Min:** 2912
- **Mode:** 3002
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• NetRisk® inherent integration with planning process
• Enhanced schedule modeling capabilities
• New cost functionality

These are the reasons why NetRisk® is the tool that allows risk professionals to bring risk management into the future of project planning
Thank You!