Project Risk
Unscrambling Risk Ownership, Management Reserve, and Contingency

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Unscrambling Risk Ownership

• Project cost overruns have kept DOE on GAO’s High Risk List for years
• Pre-symposium survey identified these systemic issues:
  – poor risk assessment and analysis
  – inadequate Contingency and Management Reserve
  – unknown unknowns
• Who owns Contingency and Management Reserve?
  – **Contractor is responsible** for risks within its ability to estimate or control, e.g., variance in the cost of steel or labor, meeting NQA-1 requirements, site safety
  – **DOE is responsible** for risks outside contractor’s control, e.g., scope/schedule changes, funding, economic conditions, legal and regulatory changes
  – Line between contractor and DOE control should be drawn in the contract. Acquisition Strategy and contract terms need to address risks and clarify responsibilities and expectations.
Risk Elements in Cost Estimating

• **Key cost estimate objectives:**
  – **CD-1 Range Estimate** – high probability TPC will be within broad range. Requirement to redo CD-1 if top end of original CD-1 cost range grows more than 50% as proceed toward CD-2.
  – Projects will be delivered within original CD-2 Performance Baseline (cost and schedule) and be fully capable of meeting mission and key performance parameters. Baselines to be established with 70-90% confidence in cost and schedule.

• **Perform Uncertainty Analysis to Measure Risk**
  – **Uncertainty**: quantifiable variance of a cost method or input
  – **Risk Register**: list of events that, if they occur, result in a cost consequence or opportunity
  – **Risk**: the chance of loss or injury. In the context of cost analysis, risk is the probability a selected budget will be exceeded

• Usually, the contractor faces more uncertainty and DOE faces more risk; but the contract can be used to change the distribution (use of fixed prices, incentives, etc.)
Risk Estimating Process

• Clearly define “what” is being estimated (WBS)
  – Define assumptions, cost methods and the input variables that drive the cost methods
  – Validate input data, assess uncertainty, add a risk register
  – Do not add risk register items that are already addressed in the uncertainty model

• The cost uncertainty model grows as the project definition is refined
  – Uncertainty models grossly underestimate the project variance if correlation is not properly addressed, a problem that gets worse as the model gets bigger
  – Any good uncertainty model can be used to identify cost and uncertainty drivers: candidates for risk mitigation plans

• Develop standard, effective cost risk reports and metrics that provide management actionable info
Effective Cost Risk Reports

1. **Pareto Chart**: identifies WBS elements that contribute most to the target row *total*

2. **Tornado/Spider Chart**: identifies the uncertain variables that most influence the target row *total*

3. **Variance Analysis (Rollup)**: identifies WBS elements that contribute most to the target row *uncertainty*

4. **Variance Analysis (Driver - not shown but similar in appearance to RollUp)**: identifies the defined distributions that contribute most to the target row *uncertainty*

5. **Cost/Schedule Joint Uncertainty**: Find the joint probability to meet both cost and schedule targets
New DOE Resources Available

• As mentioned in yesterday’s talks, the quality of your estimate will be measured against the GAO Cost Estimating and Assessment Guide Checklists

• To help, DOE created new tools based on the GAO Guide
  – DOE O 413.3B established new, clear, robust project management requirements
  – New Cost Estimating Guide - DOE G 413.3-21
  – New Risk Management Guide - DOE G 413.3-7A
  – PMCDP Training Courses
Thoughts for Discussion

• What happens to “bounding assumptions” excluded from project analysis/contingency?
  – Involves portfolio management issues and available funding/contingency at either Program or DOE level.

• A key DOE risk for all projects is contractor performance (either better or worse than planned).
  – Evaluation should consider type of contract, incentives in place, contractor history, etc.

• Experience shows not all risks identified – what about “unknown unknowns”?
Backup
Key Elements of a Meaningful Cost Risk Analysis Process

- Clear definitions and goals:
  - Define what a Point Estimate is, its role and its content
  - Clarify the difference between uncertainty and risk
  - Agree on a standard process and reporting
  - Develop metrics to measure quality and completeness

- Point Estimate
  - Describe the effort (detailed work breakdown structure)
  - Populate the WBS with the best method to estimate each element
  - Overall, total result is NEVER the most likely cost
  - The point estimate is the anchor for the uncertainty analysis

- Uncertainty vs Risk
  - **Uncertainty**: the indefiniteness (range) of a specific element in the estimate
  - **Risk**: a chance of loss or injury. In the context of cost analysis, risk is the probability a selected budget will be exceeded.
  - Perform **Uncertainty** analysis in order to measure **Risk**
Standard Processes and Metrics

- **Standard processes**
  - Build a *functional* cost model
  - Assess uncertainty at the “Input” or the “Output” level
  - Define uncertainty distribution shapes/dispersions standards
    - Based on objective (historical) rather than subjective (expert) data
  - Build in functional correlation and also apply it where necessary
  - Add a risk register (discrete risks to the project)
  - Use simulation techniques to combine uncertainties
  - Map statistical results (do not sum) to inflated, phased results that do sum

- **Metrics to Assess Uncertainty Result Quality and Completeness**
  - **Coefficient of Variation (CV):** \( \frac{\text{StdDev}}{\text{Mean}} \) a unitless measure of uncertainty that can be used to assess and compare model results
    - For some commodities, CV is generally between 0.15 and 0.35 at the total level
  - **Probability of the Point Estimate:** Extreme high or low result should be questioned
    - For some commodities, the point estimate is generally between 20-35%