AO Cost Workshop
Step 1 Cost Data
and
AO Price Evaluation

17 April 2008

Ball Aerospace & Technologies Corp.
Agility to innovate, Strength to deliver.
The AO Cost Equation

- Science Objectives and Mission Requirements integral to Estimating Cost
  - Science Objectives + Define Mission Requirements = Cost Estimate

- Mission Requirements (implementation changes) likely to continue to evolve
  - Multiple AOs, Multiple PIs, limited missions, limited AO response time and resources
  - “Cost cap” environment encourages “stuffing of scope” in order to maximize mission value
  - Quantifying unknowns (risk reserves) difficult in environment of changing requirements

- Step 1 AO cost data based on risk-averse generic design(s), derived from historical analogs
  - Analogs contain “spent” historical reserves originally held by centers as “contingency”
  - Caps include center contingency (30%) - yet risk evaluation is part of AO process
  - Detailed tables and MELs by WBS, time phased, supplied within a dynamic Step 1
  - “Correct” at the top level, but not verifiable at the detailed level

- Resulting detailed data yields a high degree of False Precision (accuracy)

**Step 1 Inappropriate Time to Evaluate Detailed Cost Data**
Step 1 Cost Evaluation Criteria

- Components of a good cost estimate are Reasonableness, Completeness, and Credibility
  - Completeness and Credibility require detailed data that is tied to likely execution scenario
  - Detailed data requires well-defined program Scope and Risk
    - Completeness and credibility likely to be unattainable with data of suspect precision
  - Based on what is known at time of Step 1 Selection
    - Completeness and Credibility require program definitization that may not exist until Step 2
    - Analogs, with embedded “spent reserves”, are representative of likely mission costs
    - Identifying and quantifying specific threats to Step 1 pricing should occur during Step 2
    - Analogs can be analyzed to assess applicability to proposed candidate missions
  - Top level cost data (for an analog or model) has comparable utility to more detailed data (of the same analog or model) in a Step 1 evaluation process
  - “Reasonable expectation” of fitting within a cost cap is the appropriate criteria at Step 1

Evaluation Standard in Step 1 Should Be Cost Reasonableness
Cost Data Appropriate to Assess Step 1 Reasonableness

- Evaluation Phase (Ph A)
  - Cost detail reasonable since Phase A represents real outlays planned to be expended in support of a specific scope of work – e.g., defining the mission
  - Phased $ by calendar month, identifying staffing mix and levels

- Execution phases (Ph B/C/D/E)
  - Cost detail need only be summarized at “Level 2” as part of Step 1 submission
    - Mission level – Program Office (PM, SE, MA), Launch Vehicle, Post-Launch
    - Major deliverable level - Bus, Instrument 1, Instrument 2
    - Specify assumed GFE (if applicable)
  - Parametric or analog data, with model inputs, as a complement to Level 2

- Inflation – tie estimate to same year dollars as cap – organization differences are not material
- Strictly limit the data accepted (ceiling, not floor) – over-delivering encourages “false precision”
- Clearly define reserve methodologies - $ within cost cap or spread among elements, pricing of schedule reserve

Tailor Required Cost Data to Evaluate Reasonableness
**Recommended B/C/D/E Step 1 Cost Table**

<table>
<thead>
<tr>
<th>Mission Element</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch Vehicle</td>
<td></td>
</tr>
<tr>
<td>PI Mgmt team (PM, Science)</td>
<td></td>
</tr>
<tr>
<td>Industry Team (PM, SE, MA)</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>Instrument 1</td>
<td></td>
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<td>Instrument 2</td>
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<td>Instrument n</td>
<td></td>
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<tr>
<td>Observatory I&amp;T</td>
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</tr>
<tr>
<td>Flight System GSE</td>
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<tr>
<td>Launch System GSE</td>
<td></td>
</tr>
<tr>
<td>Post-Launch Support</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

**PI Team Cost Data Appropriate to Evaluate Reasonableness**

*Step 1 Data Requirements*
Recommended AO Cost Maturity Model

Step 1 Data Requirements

Step 1 Evaluation

Generic

Science Objectives

Define

Mission Requirements

Drive

Cost Estimate

Step 2 Evaluation

Specific

Science Objectives

Define

Mission Requirements

Drive

Cost Data

Plan to Advance from “Reasonable” to “Complete and Credible”