



Lessons Learned

A Case Study in Labor Cost Estimating in a Data-Scarce Environment
Overcoming the Challenges of Data Scarcity

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Agenda

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Introduction

- Cobec Consulting's primary experience is in providing cost estimation for Federal Aviation Administration (FAA) programs
- Cost estimating at the FAA is challenging with respect to data
 - Programs are dissimilar and lack comparability
 - Programs tend to be *automation/software*-intensive, rather than *manufacturing/hardware*-based, so data sources like price lists and BoM's (bill of materials) play a lesser role
 - Information sharing across programs is limited. Program offices are "stovepiped". There is no centralized repository for project data
- Subject Matter Expertise is used extensively in cost estimation at the FAA

SCEA Assumptions

- In contrast, SCEA is data-centric
 - CEBoK “Testable Topics” list presumes data readily available to analyze
 - Module 3 Parametrics
 - Module 4 Data Collection
 - Module 6 Data Analysis
 - Module 7 Learning Curve
 - Module 8 Regression
 - Module 10 Probability & Statistics
 - Expert Opinion
 - A “subordinate technique”, not one of the 3 essential cost estimating techniques
 - “...not widely considered to be a valid technique” (SCEA module 2)
 - SCEA journal, papers, presentations are heavy on data analysis

Problem

- Provide independent cost estimate for large services contract
- Multifaceted labor effort
 1. System Engineering
 2. System Integration
 3. Program Management of the contract
- Short turnaround time (several months)
- Estimates of labor efforts and labor rates needed

Part 1: Labor Effort Estimation

Objectives

- Collect labor estimates that reflect the Statement of Work (SOW) and labor categories specified in the Request for Proposal (RFP)
- Meet deadline for submitting cost estimate and RFP to agency financial reviewers, so that RFP could be approved for release to potential bidders

Actions

- Identify/assign Subject Matter Experts (SMEs) by Statement of Work (SOW) section
- Design Labor resource collection template (# of Full-Time Equivalents, by SOW section, by Year)
- Distribute Labor resource collection template to Subject Matter Experts
- Compile inputs collected from SMEs
- Review for reasonableness, overlap, adjust as necessary

Labor Resource Collection Template

SME	Section	Task Title	Labor Category	Skill Level	Year 1		
					FTE	Durat	Total
	1	SYSTEMS ENGINEERING					
Bob	1.1	DESIGN					
	1.1.1	Design Reviews					
	1.1.2	Technical Meetings					

- Chief Engineer
- Computer System Analyst
- Contracting Officer
- Contracts Specialist
- Financial Analyst
- Hardware Engineer
- Scheduler
- Software Engineer

Outcomes

1. Overlap/redundancy
2. Questionable numbers at roll up level
3. Program Management effort unreasonably high?

Outcome #1:

Redundancy among support labor (schedulers, support staff)

- Many SMEs estimated support labor as part of the tasking for their particular RFP sections
- In any given year,
 - Support Staff 10-15% of total labor
 - Schedulers 3-5% of total labor

Outcome #2

Pure build-up approach resulted in interesting/unfeasable totals when rolled-up

- 1.6 FTE Contracting Officers
 - 3.5 FTE Chief Engineers
- } Would expect only 1 of each
- Total number of FTEs in initial years of the contract came to over 2X the number of program office support FTEs

Outcome #3

Program Management too high?

- Nearly 30% of total labor effort
- Aside from the SMEs simply overestimating the program management effort, were there any other reasons for this?

Outcome #3: Program Management too high?


- Overlapping efforts
- If you ask for labor efforts to be submitted for each sub-section, you'll get efforts...
 - Example: Each sub-section of Section 4.x Program Control contained estimated labor efforts
 - Section 4.x.1 Earned Value Management
 - Section 4.x.2 Financial Metrics Reporting. *Likely covered in the EVM section, 4.x.x*
 - Section 4.x.3 Performance Metrics Reporting. *Again, possibly covered by EVM labor estimate*
 - Example #2: Section 1.1.x Help Desk
 - Section 1.1.x.1 Toll Free Number. *Indicates toll-free number must be provided; labor negligible*
 - Section 1.1.x.2 Hours of Operation. *Indicates the help desk's minimum hours of operation; no labor needed*

Recommendations (1 of 4)

Regarding the Overlap issue

- Be careful that the Statement of Work's construction doesn't influence expert opinion
- SME input should only be influenced by the work described in the SOW, not by the organization or formatting of that work
- Recommendation: For collecting labor resource estimates, summarize SOW language in such a way that it does not rely on, or is independent of, sub-sections
 - Example: Section 4.x.1 Earned Value Management, to include:
 - Financial Metrics Reporting
 - Performance Metrics Reporting
 - Example #2: Section 1.1.x Help Desk, to include:
 - Toll Free Number
 - Hours of Operation

No longer called out in specific sub-sections



Recommendations (2 of 4)

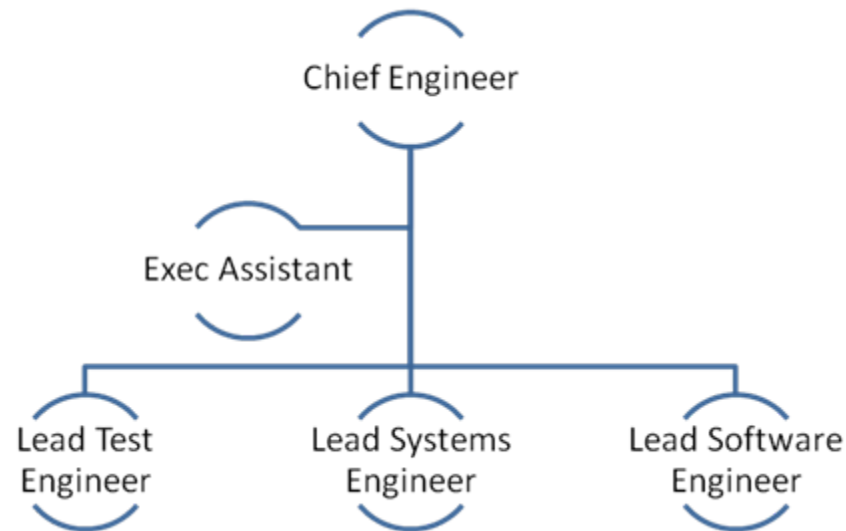
Regarding the Program Management % of Total Effort issue

- Program Management effort is generally thought of as a function of the main effort
- Wait until all other efforts have been estimated before estimating PM
- *What level of effort would be needed to support a primary effort of this size?*

Recommendations (3 of 4)

Regarding the Build-up/unreasonable FTE totals issue

- Consider creating an organizational chart for the effort, which acts as a pool of available labor to draw from



- Or, simply adjust the unreasonable numbers (i.e., 1.6 contracting officers → 1.0 contracting officer)
- To the extent possible, *cross-check* against other efforts in the agency

Recommendations (4 of 4)

Regarding the Redundancy issue

- Instructions to SMEs must specify exclusion of support staff and program management categories, like schedulers
 - These efforts would be estimated secondarily
- Take a step back with a smaller, knowledgeable team and review the entire estimate
 - Analyze the data collected
 - Summarize effort by labor category, by contract year
 - Graph the profile of the labor effort, review peaks and valleys against contract and program milestones

Additional Note: Durations

- Durations of each task were also Subject Matter Expert input
- Some adjustments to durations were made during the reasonableness review
- No observations stood out in this case study
- One recommendation: Instruct SMEs to include linkage to key milestones wherever possible.
Examples:
 - Deliverables' due dates, i.e. Contract Date Requirements List (CDRLs)
 - System commissioning dates

Part 2: Labor Rate Estimation

Objectives

- Develop labor rates in accordance with agency financial reviewers' guidance
 - GSA rates = bad
 - Forward Pricing Rates = good
 - Show rate build-up, i.e. direct & indirect components
- Reflect labor categories and experience levels specified in the RFP
 - 30+ categories, 5 experience levels: over 150 total labor categories
- Meet deadline!

Data

- Data is less “scarce” than in the Labor Resource Estimation effort. Potential sources:
 - General Services Administration (GSA) schedule
 - Bureau of Labor Statistics compensation data
 - Agency contracts
 - FAA EFAST (small businesses)
- Ideally,
 - Would have agency agreed-on labor rates (forward pricing rates) for a number of potential bidders
 - These rates would feature a variety of labor category/experience level combinations, facilitating a mapping to the RFP’s categories

GSA Rates vs. Forward Rates

GSA rates

- Pros
 - Available for nearly all potential bidders
 - Many categories available which can be mapped to RFP labor categories
 - Rates by category can be averaged across contractors
- Cons
 - Agency reviewers consider GSA rates unrealistic (too high, not discounted)
 - Not broken down into components (Direct, Overhead, G&A)

Forward Pricing Rates

- Pros
 - Agency reviewers' preference
 - Realistic (currently in use by other programs in agency)
 - Component breakdown available
- Cons
 - Only 2-3 contractors; insufficient time to acquire more Forward Pricing Rate Agreements
 - Categories not mapped to RFP labor categories
 - Indirect component breakdowns vary substantially
 - Transparency/documentation (rates must not be shared)

Solution

- Started with GSA rates for a number of potential bidders
- Mapped GSA rate categories to RFP categories
- Averaged GSA rates by category across contractors
- Obtained a handful of Forward Pricing Rate Agreements
- Used Forward Pricing Rates to estimate direct/indirect rate breakdown
- Applied rate breakdown to GSA rates

Example: Mapping GSA rate categories to an RFP category (*Hardware Engineer*)

	Contractor				
Hardware Engineer	1	2	3	4	5
A (highest experience/education)	no match	Mechanical/ Electrical Engineer 1	no match	Senior Engineer 1	HW Development Engineer 1
B	no match	Mechanical/ Electrical Engineer 2	no match	Senior Engineer 2	HW Development Engineer 2
C	no match	Mechanical/ Electrical Engineer 3	no match	Intermediate Engineer 1	HW Development Engineer 3
D	no match	Mechanical/ Electrical Engineer 4	no match	Intermediate Engineer 2	HW Development Engineer 4
E (lowest experience/education)	no match	Mechanical/ Electrical Engineer 5	no match	Electronics Technician	HW Development Engineer 5

Example: Averaging GSA rates by category across contractors

“Mechanical/Electrical Engineer 1”

	Contractor					
Hardware Engineer	1	2	3	4	5	Average
A (highest experience/education)	no match	\$284	no match	\$200	\$280	\$255
B	no match	\$240	no match	\$150	\$220	\$203
C	no match	\$190	no match	\$120	\$141	\$150
D	no match	\$152	no match	\$100	\$110	\$121
E (lowest experience/education)	no match	\$122	no match	\$72	\$68	\$87

Example: Applying Forward Pricing Rate Agreements

Contractor Forward Pricing Rate Agreements				
Rate Component	1	2	3	Average
Direct	37%	41%	43%	40%
Overhead	40%	70%	60%	57%
G&A	30%	25%	10%	22%

Hardware Engineer	Average GSA	Direct	Overhead	G&A	Rate before Fee
A (highest experience/education)	\$255	\$102.72	\$58.21	\$34.87	\$195.79
B	\$203	\$82.01	\$46.47	\$27.84	\$156.32
C	\$150	\$60.63	\$34.36	\$20.58	\$115.58
D	\$121	\$48.67	\$27.58	\$16.52	\$92.77
E (lowest experience/education)	\$87	\$35.22	\$19.96	\$11.96	\$67.14

Calculated on previous slide

Results

- A set of labor rates for over 150 labor category-experience levels specified in the RFP, broken down by direct and indirect components
- Commendation from agency finance reviewers on this methodology

Summary

- We discussed the role of Expert Opinion in labor resource estimation
- Cost Estimators play a vital role in shaping the framework of expert opinion input collection
 - Summarize SOW to help avoid overlap
 - Instructions to SMEs to help avoid redundancy
 - Facilitate top-down estimating (e.g., the org chart) and cross-checks
 - Review results and adjust as necessary
- We discussed the use of multiple data sources in labor rate estimation
 - Use the sources that are available
 - Take advantage of the “pros” of each source
 - Address the “cons” of each source

Final Thoughts on Expert Opinion

The discussions that arise around SMEs' inputs can prove valuable in terms of providing feedback to acquisition and contracts personnel

- They can reveal insight into the work that is being solicited
- Provides opportunity for the Statement of Work to be revised to address confusion or overlap
- High estimates may call into question the need for / affordability of certain tasks

Questions

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