



Software Data Collection and Analysis for Proposal Evaluation

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Today's Presentation

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Introduction

- Software development is an area of chronic cost growth for DoD acquisition programs.
- Analysis of completed software development programs indicates that percent change in actual versus estimated development cost ranges from 8% to 231% and averages 98% [1].
- A significant contributor to the growth has and continues to be unrealistic software sizing estimates, the source of which can be the Government or industry software development teams responsible for the work.

Table 2: Program Outcomes Linked to Management Controls

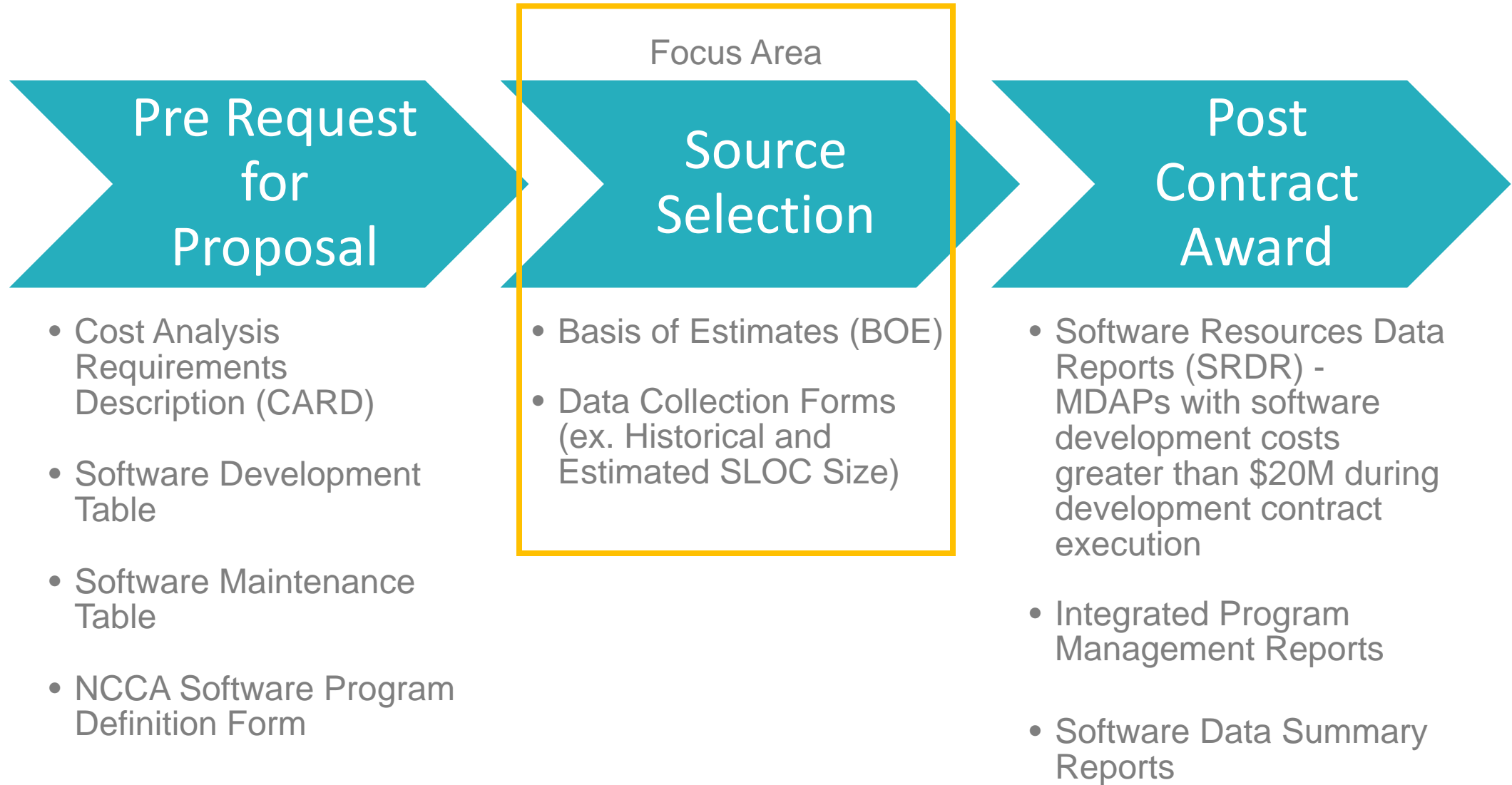
Program	Evolutionary environment	Disciplined process	Use of meaningful metrics	Percent change in research, development, test, and evaluation cost estimate	Percent change in cycle time estimate
Tomahawk	Yes	Yes	Yes	7.6	22.4
F/A-18 C/D	Yes	Yes	Yes	36.4	6.2
F/A-22 ^a	No	No	No	127	104
SBIRS ^a	No	No	No	88	Not available
Comanche ^a	No	No	No	231	120

Source: GAO's analysis of DOD programs and selected acquisition reports.

^aGAO's assessment of the evolutionary environment, disciplined process, and use of meaningful metrics addresses conditions found before these programs were restructured.

[1] GAO-04-393. "Stronger Management Practices Are Needed to Improve DOD's Software-Intensive Weapon Acquisitions." Mar. 2004.

Software Data Collection Background & Timeline



Data Collection Form Basics

- Include a data collection form (MS Excel or other template) as a Section J Attachment in the RFP to improve the evaluation of proposed software development efforts (process, productivity, and BOE traceability).
- Provide additional instructions and data field definitions as needed to support accurate data collection. The more prescribed the form is, the less variation in offeror submissions.
- For each RFP, the form is tailorable to program, acquisition strategy, and source selection specific requirements.

SLOC Summary Table Example

- **Section 1: Work Breakdown Structure (WBS) & Computer Software Configuration Item (CSCI)**
 - Report the effort for all software and firmware efforts by WBS, traceable to the Cost and Software Data Report (CSDR) Plan, if applicable.
 - Report CSCI effort at the Computer Software Component (CSC) level or Computer Software Unit (CSU) level in order to document historical SLOC planned for modification or reuse.
- **Section 2: Activity Description (Requirements and BOE Traceability)**
 - Delineate Prime / Subcontractor efforts.
 - Define the technical capabilities of each CSCI and mapping to SOW matrix and requirements.
 - Provide traceability to BOEs.
- **Section 3: Historic Effort Performance & Description**
 - Deliver SLOC (or other size measure) for historic efforts by mapping the completed functions to new capabilities, where reuse code is proposed.
 - Document SLOC size by prescribed code counting method (require same method for all offerors to ensure consistent counting practices and type (Physical versus Logical)).
 - Document historic effort by programming language, period of performance, contract number, total hours, Design, Code, Test and Integration (DCTI) hours, non-DCTI hours, End-to-End or DCTI productivity, and defect rate.

SLOC Summary Table Example (continued)

■ Section 4: Proposed Effort (Size)

- Document the amount and applicability of planned reused code.
- Proposed New, Modified, and Reuse Delivered SLOC.

■ Section 5: Proposed Effort (Effective/Equivalent SLOC)

- Document equivalent new SLOC (ESLOC) conversions, including supporting data and calculations.

■ Section 6: Proposed Hours (Productivity)

- Document productivity (ESLOC/Hour) metrics using historical performance with data and calculations for supporting adjustments, if required.

SLOC Summary Table Benefits

Recognized by Acquisition, Technology & Logistics (AT&L) Defense Procurement and Acquisition Policy (DPAP) as a DoD acquisition best practice

- A fair and balanced source selection necessitates evaluating offerors in a consistent manner
- A standard template reduces inefficiencies in data analysis by eliminating the need to map different data formats into a uniform structure
- Reduces subjectivity when categorizing and reviewing data for consistent analysis
- Ask the right questions to determine relevance of proposal data, verify metrics and analyze historical data
- Software labor/effort data collection form that provides the necessary information for the Government to assess the validity of proposed software development efforts
 - Validate contractor proposals for realism and perform tradeoff analysis
 - Understand and define the efficient use of SLOC
 - RFP J Attachment (ex. MS Excel)

WBS	CSCI	Activity Description			Historic Effort (Program/CSCI)	Programming Language
		Performing Agent	Functional Purpose and Description (Reference Technical Section)	BOE Number (Reference Proposal Volume, Section, Book, and Page)		
##	Past Performance					
###	Primary Function(s)					
####		Prime			<All New Code>	C++
		Prime			Program X (AN/SXX-YY)/ CSCI Z	C++
		Subcontractor A			:	
		Subcontractor B			:	
####		Prime			<All New Code>	C++
		Prime			Program X (AN/SXX-YY)/ CSCI Z	C++

Implementation of RFP Data Collection Form

- Utilizing an RFP Section J attachment for software data collection leverages the competitive RFP environment to collect information that may otherwise be difficult to obtain for software intensive weapon systems or Major Automated Information System (MAIS) development efforts.
- WBS within the data collection form should request data at the lowest reportable level, the Computer Software Unit (CSU). The CSU is the smallest subdivision of a Computer Software Configuration Item (CSCI) for the purposes of engineering management.
- Implementing a WBS specific to system type and tailoring data fields, including multiple software development processes (agile, incremental, waterfall, etc.), and counting methods (SLOC (consistent counting methods), Function Points (size, not effort!) and Agile Metrics (User Stories, Features, etc.) ensures consistent depth of evaluation for all offerors' development approaches.
- The data field definitions will prescribe the units of measure, ensuring consistency across proposals. For SLOC measurement, the University of Southern California (USC) Unified Code Counting (UCC) tool provides standard definition and consistency.

Software Data Analysis Approach

- The list that follows represents the types of questions that the software data collection form enables C/PAT analysts to explore when evaluating a proposal (i.e., software related BOEs) against reported historical performance:
 - Is proposed reuse code less than the total DSLOC on the source program?
 - How does the proposed software development productivity align with previous performance?
 - Is it realistic to achieve greater productivity on a new, more complex system, than previous efforts (even with new software development methods such as agile)?
 - Are the DCTI hours proportional to the non-DCTI hours?
 - Is there effort proposed for all software development activities?
 - Is the historical data decomposition, ideally at the CSU level, in alignment with the proposed effort?
 - Are adjustment factors for productivity or reuse efforts justified by the historical data provided?
 - Are the BOEs adjustment factors based on analogous data or industry standards from 'black box' software estimating tools?

Desired Outcomes

- Performing proposal analysis using a traceable MS Excel file produces more credible, defensible evaluations. Evaluation of proposed software development effort via a customized data collection form enhances the ability to efficiently perform:
 - BOE Validation
 - Requirements Traceability
 - Price realism adjustments
 - Value Adjusted Total Evaluated Price (VATEP) tradeoffs
 - Risk identification

In Conclusion

- Collection of historical software development and maintenance data contributes to more realistic software sizing and effort estimates at critical decision milestones throughout a program's lifecycle.
- During RFP development, proposal evaluation, and source selection discussions, the implementation and use of SLOC Summary Tables to collect software labor/effort data provides the necessary information for the Government to assess the validity of proposed software development efforts.
- Including the SLOC Summary Table in the Section J Attachment of the RFP improves the information available to evaluate proposed software development efforts (process (agile, waterfall, etc.), productivity, and BOE traceability) and supports the analysis required to perform realism adjustments.
- Access to historical data provides additional leverage to the Government in negotiations.
- Software labor data requested in this form enables the Government to assess the validity of proposed software development effort, productivity, software sizing, staffing and schedule.
- Analysis of proposal data supports fact finding during evaluation, specifically asking the right questions and understanding the risks.
- C/PAT analysts use the data collection and evaluation approach to evaluate offeror estimates for consistency with historical data and to support value-based adjustments.
- The data collection form assesses consistency within the price and technical proposal volumes and supports cost realism adjustments for VATEP that feed trade-off decisions.

Let's stay in touch



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Ken Rhodes is a CCE/A certified Senior Analyst / Project Manager at Technomics. He has ten years of experience performing cost analysis and acquisition support for the Army, Navy, Air Force, Marine Corps, and OSD, and specializes in the areas of software development and advanced radar life-cycle cost estimating. He has performed multiple Business Case Analyses (BCA), Integrated Baseline Reviews (IBR), and cost / price assessments for defense programs.



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Thank you!

