

UNDERSTANDING BASIS OF ESTIMATE (BOE) METHODOLOGIES IN GOVERNMENT PROPOSALS

December 14, 2022

CohnReznick LLP



MEET COHNREZNICK – OPTIMIZING PERFORMANCE

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AGENDA

- Understanding the Basis of Estimate
- Estimating System
- Estimating Methodologies
- Cost Accounting Standards
- Proposal Adequacy
- Truthful Cost or Pricing Data
- Questions & Answers

To Do

- 4.00 - WALLOW IN SELF PITY
- 4.30 - STARE INTO THE ABYSS
- 5.00 - SOLVE WORLD HUNGER (TELL NO-ONE)
- 5.30 - JAZZERCISE
- 6.00 - DINNER WITH ME - I CAN'T CANCEL THAT AGAIN!
- 7.00 - WRESTLE WITH MY SELF-LOATHING





UNDERSTANDING THE BASIS OF ESTIMATE

WHAT IS A BASIS OF ESTIMATE?



- A Basis of Estimate (BOE) explains the logic, method, data, and calculations used to estimate the resources required to perform the work described in the statement of work (SOW), performance work statement (PWS), or Statement of Objectives (SOO).
- The BOE documents the thought process, approach, and rationale used to arrive at the estimate being proposed.



WHY IS THE BOE IMPORTANT?

- The BOE allows the evaluator to understand what the thought process was when the estimate was prepared
- The BOE convinces the recipient of the proposal that the estimate of needed resources is believable and will satisfy the tasks identified in the Management and Technical Volumes
- The BOE is required by Federal Acquisition Regulation (FAR) 15.4. Table 15-2
- The BOE is required to satisfy the requirements of 41 U.S.C 35, Truthful Cost or Pricing Data
- The BOE is required to satisfy the requirements at FAR 15.407-5 and DFARS 252.215-7002



WHAT WILL THE BOE ADDRESS?

- Task Description (What, Who)
 - Describe the task that is being proposed
 - Sufficiently clear that no previous knowledge is required to understand the task
 - Who will perform the task (effort)
 - Why the task (effort) is required?
- Period of Performance (When)
 - The start and stop dates for each task and subtask
 - Dates agree with the cost summary dates and the program milestone schedule.
- Explains the Estimating Approach (How)
 - How the estimate was derived (method, technique, logic)
- Explains the Estimating Rationale (Why, How much who/what)
 - Why the required effort (task) will require the proposed resources
 - Clearly documents the thought process
 - Quantifies the resources
- Clear, credible, and compliant



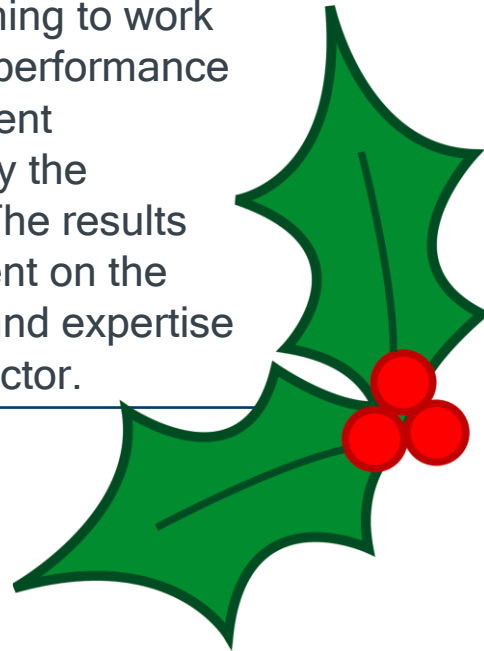
DIFFERENCE BETWEEN SOW, PWS, SOO

- Statement of Work (SOW)
 - Provide every possible detail of the objectives, process, and assessment of an acquisition
- Performance Work Statement (PWS)
 - Freedom to accomplish the task requested in the best way possible
- Statement of Objectives (SOO)
 - Desired result is more abstract rather than concrete
 - Could involve emerging technologies or innovation
 - Contractor is tasked with proposing a solution in a Performance Work Statement



PROS & CONS - SOW / PWS / SOO

	Statement of Work (SOW)	Performance Work Statement (PWS)	Statement of Objectives (SOO)
Pros	Provides the specifications that the Government is looking for to achieve the requested outcome	Encourages contractors to use innovation and cost-effective methodologies to reach the requested outcome	Empowers contractors to offer the situations to meet the objectives that are cost-efficient and effective
Cons	If the work was completed based on the statement of work as written, and it was not successful or unacceptable the fault is on the Government and not the contractor.	The outcomes are limited by the expertise of the contractor awarded the contract.	The process can be time-consuming to work through the performance work statement developed by the contractor. The results are dependent on the knowledge and expertise of the contractor.



WORK BREAKDOWN STRUCTURE (WBS)

- Work breakdown structure deconstructs a program's end product into smaller specific elements that are suitable for management control.
 - Cornerstone of every program
 - Provides a consistent framework
 - Develop a schedule and cost plan
 - Small discrete pieces
 - Essential for developing a contract cost estimate
 - Number of levels should be at the detail necessary for planning and managing the scope of work

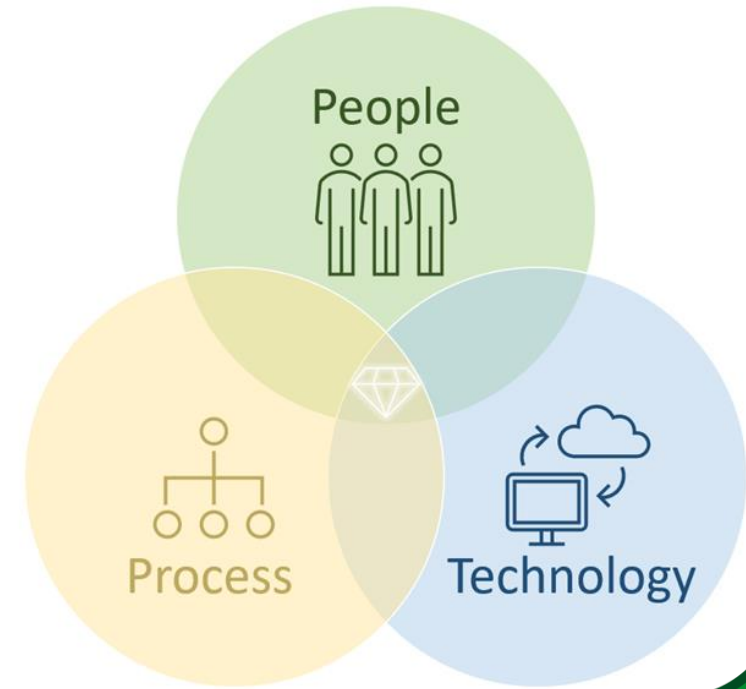




ESTIMATING SYSTEM

ESTIMATING SYSTEM ELEMENTS

- Policy and Procedures
 - Address DFARS and DCAA requirements
 - Provide for Management Reviews and Oversight
- Training
 - Appropriate for types of costs that are to be estimated
 - Minimum of annual training
- Documentation
 - Management reviews/approvals of estimates
 - Provides documentation of price/cost in response to solicitations
 - Provides details on where price/cost was obtained and why was used
 - Includes development of pro forma indirect rates should the proposal significantly impact the current rate structure
- Internal Review/Audit
 - Ensures system is working and provides reliable estimates



ESTIMATING SYSTEM ELEMENTS (CONT'D)

MORE THAN JUST THE PROPOSAL: Estimating File

- Copy of Solicitation or Amendments
- Bid/No-Bid or Gate Review Form
- Initial Basis of Estimate (BOE)
 - Direct Labor/Hours, Subcontracts, Materials, ODCs, Indirect Rates
- Price Review Form with Approval Signature
- Final, Updated BOE with Approvals
- Final Cost Submission with supporting documentation, including:
 - Price Summary Schedule (by cost element)
 - Direct Labor (FAR Table 15-2 Format & Mapped to Solicitation Format)
- Post Submission Updates



A low-angle, blue-tinted photograph of the U.S. Capitol building dome and an American flag. The flag is prominently displayed in the center, waving in front of the building's ornate facade. The sky is a deep blue with some clouds. The overall mood is formal and patriotic.

ESTIMATING METHODOLOGIES

DIFFERENT ESTIMATING METHODS

(DIRECT MATERIALS/OTHER COSTS)

DIRECT MATERIALS

- Constitutes major portion of material cost and requires expert technical knowledge to estimate.
- General estimating procedures:
 - Estimate quantity requirements;
 - Determine raw material requirements, convert measurements as necessary, and estimate actual yields;
 - Estimate current prices (quotes);
 - Adjust estimated prices for cost trends and quantities and project total cost; and
 - Document procedures and methods utilized in the estimating process.
- Bill of Materials (BOM)
 - Most frequently used method of direct material estimating.
 - Comprehensive list of all parts required to produce an item.
 - Historical data used to populate and/or data from purchasing system

ODCs

- ODCs
 - Not readily identifiable as part of the product and are not subject to labor or material indirect expense burdens.
 - Travel
 - Reasonableness (FAR Part 31.205-46)
 - Airfare
 - Rental Cars
 - Lodging
 - Consultants
 - Supplies
 - Basis of estimate: Best of 3 quotes and/or alignment with purchasing policies.

The CAM Appendix B details estimating methods for materials. (B-408.2 Estimating Methods)



DIFFERENT ESTIMATING METHODS (LABOR)

Methodologies	Definition	Increasing Level of Accuracy
Judgement and Conference	• In the absence of historical data, estimators may have to rely solely on judgment. Labor cost estimators are selected for their experience, common sense, and knowledge. • Conference method is a group consensus-method of establishing a collective estimate. • Judgment is also required to decide whether the results obtained from estimating relationships are reasonable in comparison to the past cost of similar items.	
Comparison Method (9/10) (Uses Historical Data)	• Compares items being estimated to items of similar configuration (and known cost) to produce labor estimates. • Similar to the judgment method, except that it attaches a formal logic. • Represented by the following algebraic equation: $\text{Estimated Cost (New Design)} = \text{Historical Cost (Similar Design)} + \text{Adjustments}$	
Unit Method (9) (Uses Historical Data)	• Relies on an accumulation of past experience which is divided by a cost driver to produce a cost per unit. • Also known as order-of-magnitude, lump sum, module estimating, and flat rates.	
Factor Method (Uses Historical Data)	• Extension of the unit method by using more than one factor. • The use of separate factors for different cost items should improve results.	

*Techniques listed in order of increasing estimating accuracy.
**(#) Identified within the Estimating System Criteria
***Reference Contract Audit Manual (CAM) Appendix B 407-2 for additional information.

DIFFERENT ESTIMATING METHODS (LABOR) (CONT'D)

Methodologies	Definition	Increasing Level of Accuracy
Probability Approaches	- Provisions for uncertainty in the estimating process. - Attempts to compensate for random occurrences and dependency between events. - Example: Contractor is 75% certain that it requires X days to complete Y.	
Cost Estimating Relationships (10) (Uses Historical Data)	- Statistical estimating methods that produce cost estimating relationships (CERs) and time estimating relationships (TERs). - Developed by relating cost or time estimates to a cost driving feature of the product or manufacturing environment. - In order to develop CERs and TERs, historical data on both dependent (labor) and independent (cost drivers) variables must exist. Regression analysis is then performed. (See DCAA Graphic & Regression Analysis Guidebook) - Common CERs and TERs are described by improvement curves, linear relationships, and power law and sizing models.	
Standard Time Method	- Most precise technique for estimating manufacturing labor. - Basis for estimate is a labor standard. - Actual Labor = Standard/Expected Productivity Factor	

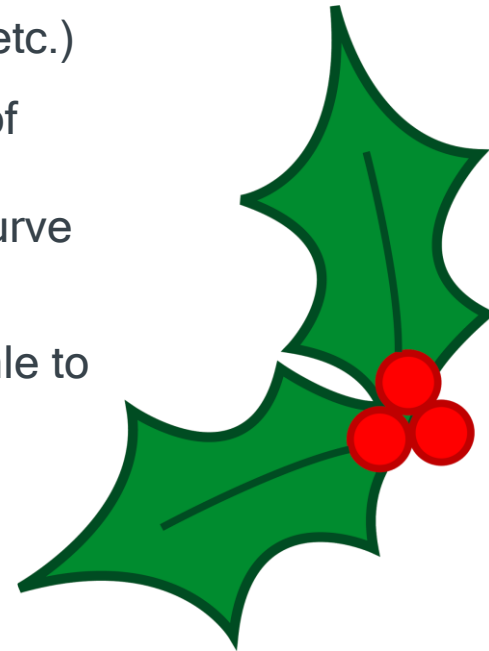
*Techniques listed in order of increasing estimating accuracy.

**(#) Identified within the Estimating System Criteria

***Reference Contract Audit Manual (CAM) Appendix B 407-2 for additional information.

BOE STEPS

- Identify who developed the estimate
- Write the task description and the required period of performance
- Review historical data
- Identify the method of estimating appropriate to the task estimated
- Explain all factors used in the estimate by clearly stating the logic used in developing the estimate (document, document, document)
- Quantify the estimate by illustrating the resources needed to perform the tasks (e.g., number of people, number of drawings, number of trips, list of destinations, dates travelling, etc.)
- Identify how and or spread the resources that will be used over the intended period of performance using level of effort, level loading, task or milestone (discretely), and computerized distribution curves (be sure to explain the rationale for the computer curve selected)
- Define the labor mix and skill level needed to support effort proposed and the rationale to support the selection:
- Carefully consider and clearly identify other direct cost (ODC)



SETTING THE STAGE FOR SCENARIO 1

WBS: 1.0 WBS Title: Expert Algorithm Development

CLIN: 0001 CLIN Title: Expert Algorithm Development

Estimator: Dr. Rudolph

Estimating Method: Comparison (historical)

Period of Performance: 1/1/2022-11/30/2022

Task Description: Expert Algorithm Development and Validation for NORAD trajectory of Santa’s sleigh cockpit seat emergency ejection.

Estimating Rationale: This proposed effort is very similar to North Pole Company’s (NPC) previous effort “Algorithm Development” under NORAD Contract F6000-20-C-0006, NPC WO1234. The proposed effort involves developing the algorithms from a set of assumptions and performing a series of test iterations to validate these algorithms, as did the work under Contract F6000-20-C-0006, NPC WO1234. WO1234 was chosen as a base to extrapolate the estimates from because the type of work performed. The algorithm development and validation is very similar to the proposed effort, and we proposed to accomplish the effort in the same way using the same labor skills. In the WO1234 effort NPC expended the following hours. (extracted from the Cost Summary Report for WO1234 dated 12/31/20, a copy of the complete WO1234 Cost Summary Report is enclosed in the proposal file, Contracts Department at North Pole Company).



LCAT	Hours	Dollars
Chief Elf	260	
Sr. Elf	380	
Assoc. Elf	1100	
Assistant Elf	500	
Other Direct Costs		
Travel	2 Trips, 1 Elf, 4 Days	\$10,000
Computer Usage		\$25,000

SCENARIO 1 METHODOLOGY

Task Description: Expert Algorithm Development and Validation for NORAD trajectory of Santa’s sleigh cockpit seat emergency ejection.

Estimating Method: Comparison (historical)

Methodology: Since this effort mirrors the previous effort so closely, there will be far fewer iterations required (approximately 1/3rd), as many of the results from the previous effort will carry over to the proposed effort. Therefore, the number of Chief Elf hours necessary for this effort can be cut in half and the number of Associate Elf hours can be cut by 2/3rds. Additionally, we estimate that the computer usage is reduced by ½, as less time will be needed in the interactive mode.

The proposed effort, however, involves nearly twice as many resulting algorithms and the estimated period of performance is consequently twice as long. Therefore, we have multiplied the previous work by a factor of 2.

The travel for the proposed effort is based upon 4 trips from the North Pole to Peterson Space Force Base as requested by the customer.



LCAT	Previous Hours	Scaling Factors	Proposed Hours	Dollars
Chief Elf	260	*.5 *2	260	
Sr. Elf	380	*2	760	
Assoc. Elf	1100	*.333 *2	733	
Assistant Elf	500	*2	1,000	
Other Direct Costs				
Travel			4 Trips, 1 Elf, 4 Days	\$20,000
Computer Usage	\$25,000	*.5 * 2		\$25,000

SETTING THE STAGE FOR SCENARIO 2

WBS: 1.0 WBS Title: Temperature Effects on CCSF

CLIN: 0001 CLIN Title: Temperature Effects on CCSF

Estimator: Mr. Grinch Fields

Estimating Method: Judgement and Conference

Period of Performance: 11/1/2022-12/1/2022 (6 weeks)

Task Description: Test, quantifying, and report on the effects at various cooking temperatures on Christmas cookie spread factor (CCSF).

Estimating Rationale: Engineering judgment is used to prepare the estimates because; the Statement of Work for the proposed effort is unlike any previous efforts performed by North Pole Company (NPC). Although NPC has experience developing computer models for different types of systems, this effort involves quantifying the effects of the Christmas cookie spread factor (CCSF) at various cooking temperatures which is an entirely new subject area for NPC. The program has been broken down into 4 tasks:



SOW	WBS	Task Description	Schedule
3.0	1.0	Total Program	Periods of Performance
3.1	1.1	Experimental Design	11/1/2022 – 11/7/2022
3.2	1.2	Data Collection & Model Development	11/8/2022 – 11/15/2022
3.3	1.3	Model Validation	11/16/2022 – 11/23/2022
3.1	1.4	Presentation of Results	11/24/2022 – 12/1/2022

SCENARIO 2 METHODOLOGY

Experimental Design: SOW 3.1, WBS 1.1

This portion will require close collaboration with the customer to detail the specific objectives of the research and the development of an experimental design to meet those objectives. I have estimated this will require 1 week of Chief Cookie Scientist time to outline the program and 1 week of Associate Cookie Scientist 1 time to formulate the initial model. This coordination will take place at the customer’s location in British Columbia, Canada. Travel expenses are based upon 1 trip for 2 persons for 6 days from North Pole to British Columbia. The Cost Description Narrative (Exhibit A) describes the methodology for estimating travel costs.

SOW	Resource	Hours
3.1	Chief Cookie Scientist	40
3.1	Associate Cookie Scientist 1	40
	Total Hours SOW 3.1	80
3.2	Technical Cookie Assistant	120
3.2	Cookie Scientist 3	8
3.2	Intermediate Programmer	500
3.2	Cookie Analyst	50
	Total Hours SOW 3.2	678

Data Collection and Model Development: SOW 3.2, WBS 1.2

Although it is difficult to precisely estimate the number of experiments that will be required to collect the population data, I have initially allocated 300 Christmas cookie types (3 Christmas cookie variations, 5 mass variations, and 20 temperature variations). Each Christmas cookie is estimated to require an average 12 minutes including set up time for a total of 60 hours. Two technical cookie assistants will perform the Christmas cookie spread formation (1 for Christmas cookie formation and 1 for cooking control and data collection). These experiments require a low level of technical skill, but some experience in experimental controls. These requirements match with NPC’s technical cookie assistant labor category. In addition, eight hours of Cookie Scientist 3 time have been allocated for supervisory experiment oversight. A Cookie Scientist 3 was deemed appropriate for the amount of formal education required and degree of experience in experimental design.

As the data is collected, it will be used to develop the computer model. We will be utilizing C++ programming language. Roughly 1000 lines of code are expected. The published estimated guideline for this language is 30 minutes/line for an intermediate programmer (The Programmer black book, current edition). Therefore, we have estimated 500 hours of programmer time in developing the model. In addition, 50 hours of Cookie analyst time have been allocated for guidance, review, and supervision.

SCENARIO 2 METHODOLOGY (CONT'D)

Model Validation: SOW 3.3, WBS 1.3

The model validation phase will consist of generating several Christmas cookie results which will be compared with empirically derived data. I expect to run 30 validation tests which will require approximately 1 hour to generate using the computer (1-hour, intermediate programmer) and 6 hours of Christmas cookie spread time. Just as in the data collection task (two cookie technical assistants will be needed to conduct the cookie spreads - 12 hours). An associate cookie scientist 1 will oversee the process (7 hours).

Presentation of Results: SOW 3.4, WBS 1.4

The presentation of results will involve 1 trip for the Chief Cookie Scientist for 1 day to British Columbia to meet with the customer and the generation of 10 copies of the documentation (1 hour of reproduction time).

SOW	Resource	Hours
3.3	Associate Cookie Scientist 1	7
3.3	Intermediate Programmer	1
3.3	Technical Cookie Assistant	12
Total Hours SOW 3.3		20
3.4	Chief Cookie Scientist	8
Total Hours SOW 3.4		8

Other Direct Costs:

- Christmas Cookie Dough: 100 pounds
 - Best of 3 quotes: \$2.00/lb. = \$200
- Propane: 2 Tank Refills
 - Best of 3 quotes: \$10/refill = \$20
- Reproduction Costs: \$45.00



COST ESTIMATING RELATIONSHIPS



- Cost estimating relationships (CERs) are developed by mathematically relating cost or time estimates to a cost driving feature of the product or manufacturing environment.
- Steps:
 1. Define the dependent variable (cost dollars, hours, etc.)
 2. Select independent variables to be tested for developing estimates of the dependent variable.
 3. Collect data concerning the relationship between the dependent and independent variables.
 4. Explore the relationship between the dependent and independent variables.
 5. Select the relationship that best predicts the dependent variable.
 6. DOCUMENT your findings.



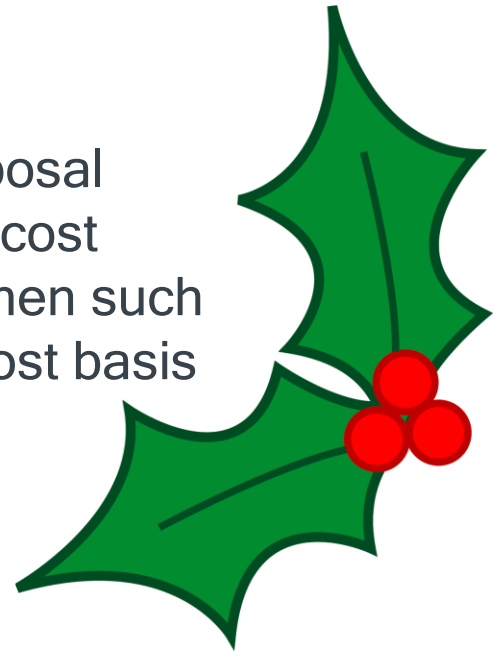


COST ACCOUNTING STANDARDS

COST ACCOUNTING STANDARDS

CAS 401 - Consistency in Estimating, Accumulating, and Reporting Costs

- (a) A contractor's practices used in estimating costs in pricing a proposal shall be consistent with cost accounting practices used in accumulating and reporting costs.
- (b) A contractor's cost accounting practices used in accumulating and reporting actual costs for a contract shall be consistent with practices used in estimating costs in pricing the related proposal.
- (c) The grouping of homogeneous costs in estimates prepared for proposal purposes shall not per se be deemed an inconsistent application of cost accounting practices under paragraphs (a) and (b) of this section when such costs are accumulated and reported in greater detail on an actual cost basis during contract performance



COST ACCOUNTING STANDARDS (CONT'D)

What does that mean?

Costs estimated for proposal purposes shall be presented in such a manner and in such detail that any significant cost can be compared with the actual cost accumulated and reported.

Practices used in estimating costs in a pricing proposal and in accumulating and reporting costs on the resulting contract shall be consistent to:

- (1) The classification of elements or functions of cost as direct or indirect;
- (2) The indirect cost pools to which each element or function of cost is charged or proposed to be charged; and
- (3) The methods of allocating indirect costs to the contract.



COST ACCOUNTING STANDARDS (CONT'D)

You can do this:

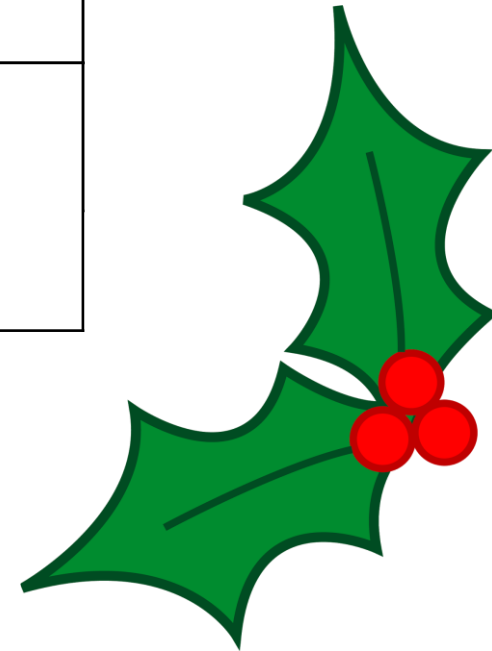
1. Contractor estimates an average direct labor rate for manufacturing direct labor by labor category or function	1. Contractor records manufacturing direct labor based on actual cost for each individual and collects such costs by labor category or function.
2. Contractor estimates an average cost for minor standard hardware items, including nuts, bolts, washers, etc.	2. Contractor records actual cost for minor standard hardware items based upon invoices or material transfer slips.
3. Contractor uses an estimated rate for manufacturing overhead to be applied to an estimated direct labor base. He identifies the items included in his estimate of manufacturing overhead and provides supporting data for the estimated direct labor base	3. Contractor accounts for manufacturing overhead by individual items of cost which are accumulated in a cost pool allocated to final cost objectives on a direct labor base.



COST ACCOUNTING STANDARDS (CONT'D)

You can't do this:

1. Contractor estimates a total dollar amount for engineering labor which includes disparate and significant elements or functions of engineering	1. Contractor accounts for engineering labor by cost function, i.e., drafting, designing, production, engineering, etc.
2. Contractor estimates engineering labor by cost function, i.e., drafting, production engineering, etc.	2. Contractor accumulates total engineering labor in one undifferentiated account.
3. Contractor estimates a single dollar amount for machining cost to cover labor, material and overhead	3. Contractor records separately the actual costs of machining labor and material as direct costs, and factory overhead as indirect costs.



A low-angle, blue-tinted photograph of a classical building, likely a government capitol, featuring a large dome and ornate architectural details. An American flag is prominently displayed on a tall pole in the foreground, waving against the sky. The text 'PROPOSAL ADEQUACY' is overlaid in large, white, bold, sans-serif capital letters on the left side of the image. Above the text is a small white graphic element consisting of a horizontal line with a diagonal slash.

PROPOSAL ADEQUACY

PROPOSAL ADEQUACY CHECKLIST

- FAR Part 15, Table 15-2 - This document provides instructions for preparing a contract pricing proposal when certified cost or pricing data are required.
 - There is a clear distinction between submitting certified cost or pricing data and merely making available books, records, and other documents without identification.
 - By submitting your proposal, you grant the Contracting Officer or an authorized representative the right to examine records that formed the basis for the pricing proposal.



PROPOSAL ADEQUACY CHECKLIST (CONT'D)

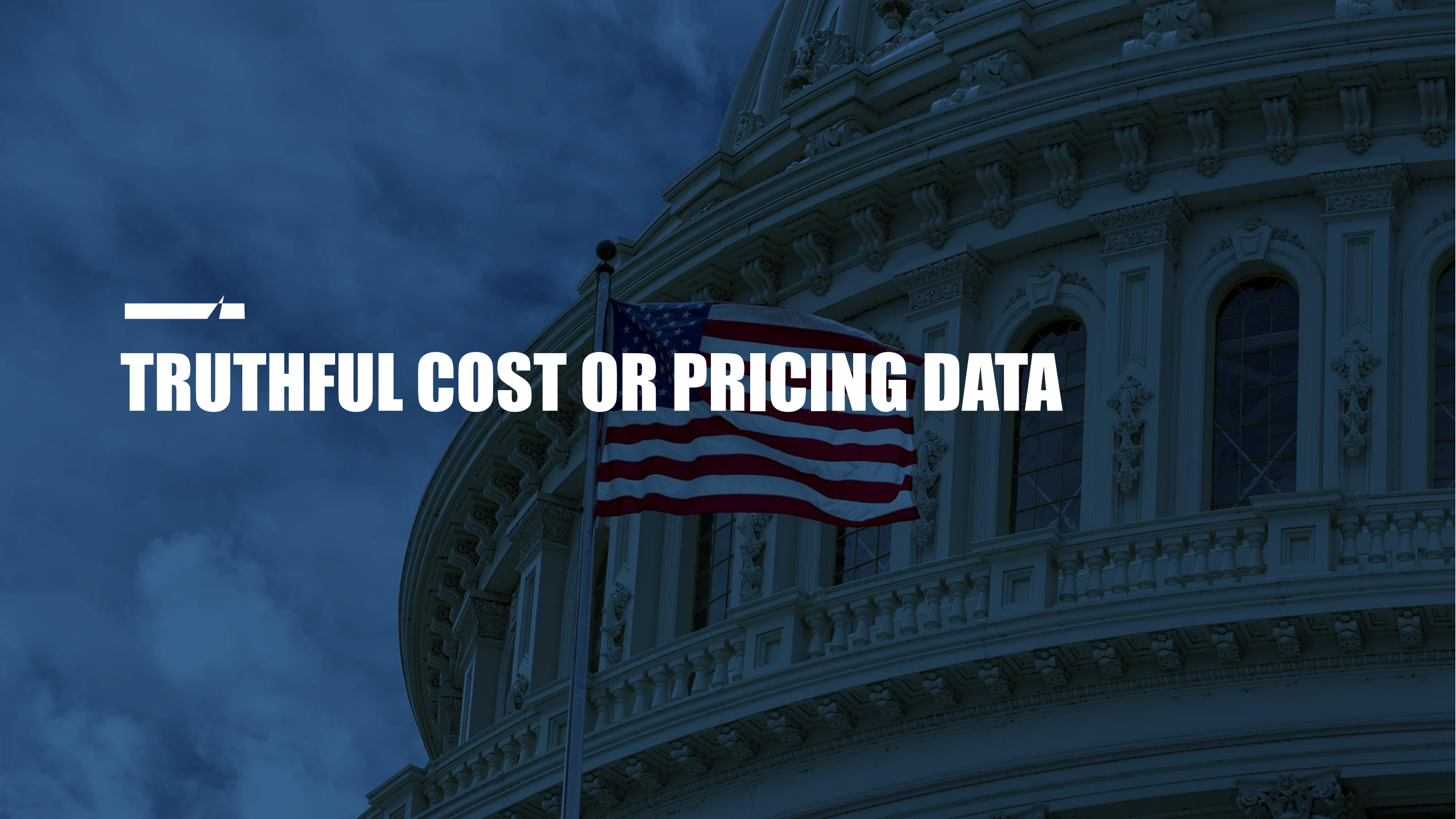
- DFARs 252.215-7009
 - The offeror shall complete the 36-item checklist, providing location of requested information, or an explanation of why the requested information is not provided.
 - In preparation of the offeror's checklist, offerors may elect to have their prospective subcontractors use the same or similar checklist as appropriate.



PROPOSAL ADEQUACY CHECKLIST (CONT'D)

- General Instructions
- Cost Elements
- Formats for Submission of Line Item Summaries
- Other (Contract type considerations, economic price adjustments, performance-based payments, pass through charges on subcontract effort)



A low-angle, blue-tinted photograph of a classical building, likely a government capitol, featuring a large dome and ornate architectural details. An American flag is prominently displayed on a tall pole in the foreground, partially obscuring the building's facade. The sky is filled with soft, white clouds.

TRUTHFUL COST OR PRICING DATA

COST OR PRICING DATA

All facts that, as of the date of agreement on the price of a contract (or the price of a contract modification) or, if applicable consistent with section 3506(a)(2) of this title, another date agreed upon between the parties, a prudent buyer or seller would reasonably expect to affect price negotiations significantly. The term does not include information that is judgmental but does include factual information from which a judgment was derived.

Cost or pricing data are more than historical accounting data; they are all facts that can be reasonably expected to contribute to the soundness of estimates of future costs and to the validity of determination of costs already incurred.



COST OR PRICING DATA (CONT'D)

The mere availability of books, records, and other documents for audit does not constitute submission of certified cost or pricing data. The regulations make a clear distinction between submitting certified cost or pricing data and merely making available books, records, and other documents without identification. The adequacy of a given submission or disclosure depends on whether the certified cost or pricing data is disclosed in a way that places the Government on essentially equal footing with the contractor in regard to making the pricing decisions.



COST OR PRICING DATA (CONT'D)

Cost or pricing data can include:

- vendor quotations
- information on changes in production methods and in production or purchasing volume
- data supporting projections of business prospects and objectives and related operations costs
- unit-cost trends such as those associated with labor efficiency
- information on management decisions that could have a significant bearing on costs



COST OR PRICING DATA (CONT'D)

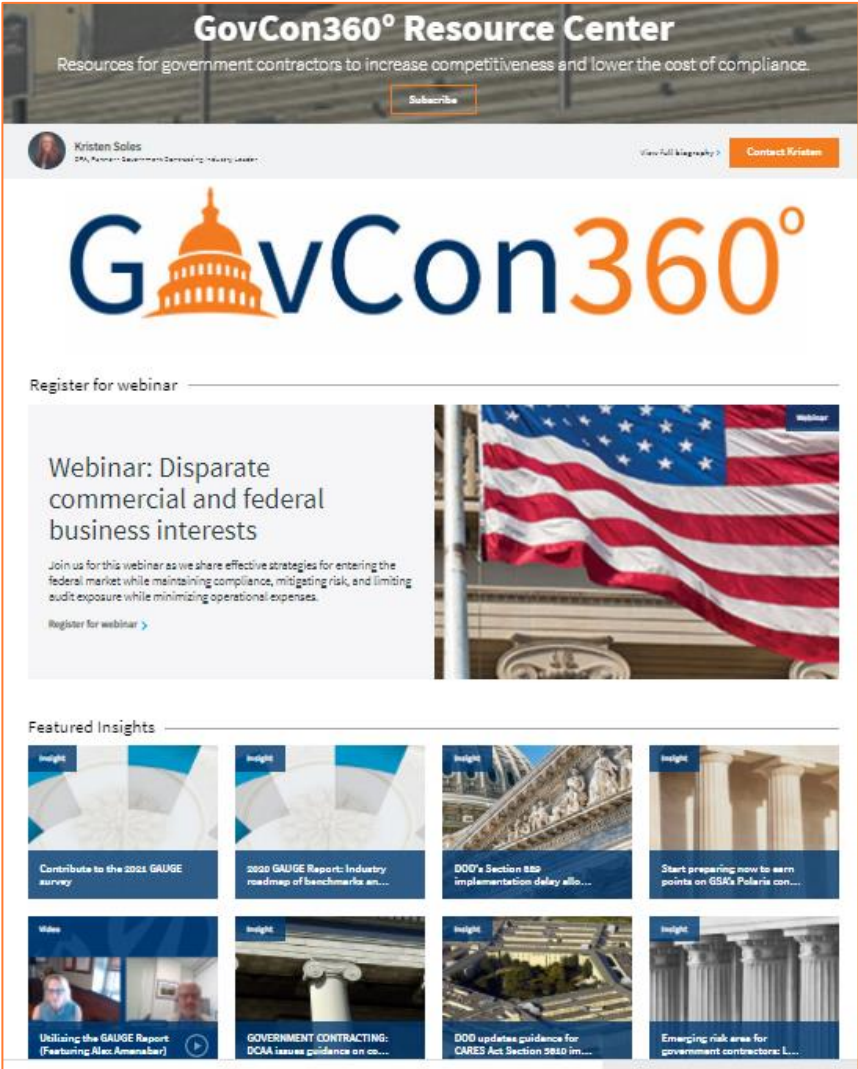
The following would not be considered cost or pricing data:

- The significance of historical data on future performance
- Estimates related to new or changed process (underlying data could be considered cost or pricing data)
- Data not reasonably available at the time of price agreement

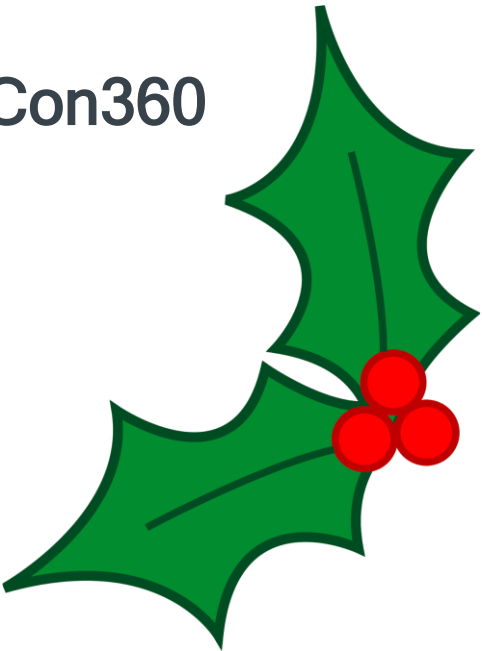




GOVERNMENT CONTRACTING RESOURCES



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QUESTIONS? CONTACT US



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