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THESIS

A PRACTICABILITY STUDY ON THE DEVELOPMENT OF A STANDARD, STAND-ALONE COMPUTERIZED CONTRACT PRICING MODEL FOR CONTRACT PRICING AND NEGOTIATIONS

by

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A Practicability Study on the Development of a Standard, Stand-Alone Computerized Contract Pricing Model For Contract Pricing and Negotiations

by

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ABSTRACT

This thesis examines the practicability of developing a standard, stand-alone, computerized contract pricing model for contract pricing and negotiations. A functional description of a proposed framework for a standard, stand-alone, computerized contract pricing model is provided. The results of data collected from a survey of DLA, Navy, and Marine Corps field contracting activities are examined and the practicability of developing such a model is analyzed.

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I. INTRODUCTION

A. PURPOSE

The purpose of this chapter is to provide the background and methodology leading to the study of the practicability of developing a standard, stand-alone, computerized contract pricing model. Along with the background and methodology, the thesis objective, research questions, scope, assumptions, and limitations are stated.

B. BACKGROUND

Developing a price proposal using the "stubby pencil" method can be both cumbersome and time consuming. A negotiator would have an extreme advantage if equipped with a personal computer that provided a computerized pricing tool to make quick recalculations of an opponent's position, as well as his own.

Advanced technology in the form of personal computers already exists at field contracting activities. However, standard software and a standard, computerized contract pricing model for use on personal computers when negotiating with industry do not exist for the Navy. Even with the advantage of personal computers at their fingertips, many activities are not using these powerful tools to their full potential. Instead, most of the people in contracting and negotiation positions use wide varieties of software to drive individually or locally developed models and spreadsheets that are tailored specifically to the activity or contracts at hand.

Therefore, the idea of a standard, stand-alone, computerized, contract pricing model has tremendous potential. A menu-driven software package based on a standard model that calculates contract prices and fall-back positions would be extremely advantageous because the price analyst and negotiator would not have to "reinvent the wheel" when preparing price proposals and conducting price negotiations. Virtually anyone in a pricing or contracting position would be able to apply it successfully. With this tool available, the contract negotiator would be able to almost instantaneously recalculate the current negotiated position in relation to a predetermined negotiation range and the contractor's price proposal.

Currently, there are Beta Test models of the Weighted Guidelines Method (WGL), for calculating profit in accordance with FAR 215.970, and Spreadsheet Triangulares (SST), for calculating probabilities of achieving given cost estimates, written for LOTUS 1-2-3 by Mr. Dale McNabb, Associate Director of Small Business, Deputy Chief of Staff for Contracting, Headquarters Air Force Systems Command. These models are available to the Department of Defense and are being distributed by the National Contract Management Association.

The author spoke with Mr. McNabb and discussed the idea of a standard, stand-alone, computerized contract pricing model. Mr. McNabb was enthusiastic about the idea and concurred with the theory of combining his WGL model with the author's proposed model into a single, standard, stand-alone, computerized contract pricing model that would calculate all cost elements and provide the total price of a contract, yielding a minimum, objective and maximum position, as well as the contractor's position, and the calculation of a current negotiated position.

A model that incorporated the features of Mr. McNabb's WGL model, plus additional features, into a standard, stand-alone, computerized contract pricing model would be a very helpful tool for Department of Defense contracting personnel. If adopted, the model's contribution would save time and money because man-hours could be devoted to price analysis and negotiating, which, in turn, would lead to increased efficiency, decreased backlogs of work and a reduction in costs based on increased efficiency.

C. OBJECTIVE

The purpose of this thesis is to examine the practicability of developing a standard, stand-alone, computerized contract pricing model for contract pricing and negotiations.

D. METHODOLOGY

A survey of Defense Logistics Agency (DLA), Navy, and Marine Corps field contracting activities was conducted to find out if any are currently using a computerized contract pricing model. A questionnaire was also used to gain feedback on what kind of software is being used and to ascertain if a standard, stand-alone, computerized contract pricing model would be of interest to them.

E. RESEARCH QUESTIONS

1. Primary Question

What is the practicability of developing a standard, stand-alone, computerized contract pricing model that will be used as a decision support system for contract pricing and negotiations?

2. Subsidiary Questions

- Do DLA, Navy or Marine Corps field contracting offices currently have computerized contract pricing models that they are using?
- Do defense contractors currently have computerized contract pricing models within their companies that they are using?
- What elements should comprise a standard, stand-alone, computerized contract pricing model and what functions should it perform?

F. SCOPE, ASSUMPTIONS, AND LIMITATIONS

The main thrust of the thesis will be to examine the practicability of developing a standard, stand-alone, computerized contract pricing model that can be programmed as a menu-driven software package using any brand of software. The focus will be on feasibility and practicality.

The author assumes the reader has a general working knowledge of contract pricing and negotiations. Therefore, contract pricing and negotiation theory will be omitted.

Firm Fixed-Price (FFP) contracts will be used to present a functional description of the proposed framework for a standard, stand-alone, computerized contract pricing model. The model will be based on the basic cost elements of a FFP contract as found in the Armed Services Pricing Manual [Ref. 1]. Those elements are:

- Direct Materials;
- Direct Labor;
- Other Direct Costs;
- Indirect Costs;
- Profit.

FFP contracts will be used because they have fewer variables to consider when conducting contract pricing and negotiations.

G. THESIS ORGANIZATION

Chapter I provides background, the thesis objective, methodology, research questions, scope, assumptions and limitations.

Chapter II provides background information concerning the preliminary research that was conducted and reviews prior research done by others in this area.

Chapter III provides a functional description of the proposed framework for a standard, stand-alone, computerized contract pricing model.

Chapter IV examines the results of the data collected from a survey of DLA, Navy, and Marine Corps field contracting activities and analyzes the practicability of developing a standard, stand-alone, computerized contract pricing model.

Chapter V answers the research questions and renders conclusions and recommendations.

H. SUMMARY

This chapter provided background information and the objective of the thesis. The methodology leading to the study of the practicability of developing a standard, stand-alone, computerized contract pricing model was stated, along with the research questions, scope, assumptions, and limitations.

The next chapter provides background information concerning the preliminary research that was conducted and presents a review of prior research that is specifically related to this thesis' area of research.

II. PRELIMINARY RESEARCH

A. PURPOSE

The purpose of this chapter is to provide background information concerning the preliminary research that was conducted and to present a review of prior research in this area of research.

B. BACKGROUND

Initially, the Defense Contract Administration Services Management Area (DCASMA), San Francisco, was contacted to ascertain if they use a standard, computerized contract pricing model. One did not exist. Each price analyst was using some sort of individually developed spreadsheet tailored to each contract. Furthermore, to the best of the DCASMA's knowledge, no standard model existed within the Department of Defense (DOD).

Next, the Naval Regional Contracting Center (NRCC), Philadelphia, Pennsylvania [Ref. 2], and NRCC, Washington, D.C. [Ref. 3] were contacted to see, again, if such a model is used. Neither NRCC had, or knew of, such a model. They, too, use individually or locally developed spreadsheets tailored to each contract, each driven by a wide variety of software.

Next, the Fleet Material Support Office (FMSO), Mechanicsberg, Pennsylvania [Ref. 4], was contacted to see if such a model was currently in development. FMSO was contacted because they are the central design agency for the Navy's inventory control points and many of their software-driven systems. They are not currently developing a contract pricing model, nor do they have plans to do so in the near future. Furthermore, they were unaware of any previous attempt to develop such a model.

Aware of a model written for LOTUS 1-2-3 that calculates profit using the WGL method, Mr. McNabb [Ref. 5], the programmer of the WGL model, was contacted and the idea of a standard, stand-alone, computerized contract pricing model was discussed. Mr. McNabb was enthusiastic about the idea and concurred with the theory of combining his WGL model with the author's proposed model into a single, standard, stand-alone, computerized contract pricing model that would calculate all cost elements and produce the total price of a contract, yielding a minimum, objective and maximum position, as well as the contractor's position, and the calculation of the current negotiated position.

Once the idea of a standard, stand-alone, computerized contract pricing model that combined Mr. McNabb's WGL model with the author's proposed model was formulated, preliminary research, with the assistance of the Dudley Knox Library Readers Services at the U.S. Naval Postgraduate School, Monterey, California, was conducted by performing a series of computer searches for similar models and research in that area.

Searches of the Defense Systems Management College (DSMC) database, the Defense Technical Information Center (DTIC) database, the National Technical Information Service (NTIS) database, the Information Services for Physics, Electronics and Computing (INSPEC) database, and the thesis and research database at the Naval Postgraduate School did not produce any reports that were related specifically to the area of research.

A computer-based search was conducted with assistance from the Defense Logistics Studies Information Exchange (DLSIE) from their database, located at the U.S. Army Logistics Management College, Fort Lee, Virginia. Three relevant references were found from this literature search. The following are the reports retrieved from the DLSIE database that are specifically related to the area of research.

1. COPPER IMPACT Guidebook: Applications of Automation to Contract Pricing and Finance

Sponsored and written in 1978 by the Air Force Systems Command, Andrews AFB, Maryland, this handbook provides information and guidance on the COPPER IMPACT project which was initiated to improve the pricing process in the Air Force. COPPER is an Air Force code word for contracting projects, while IMPACT is an acronym for the objective to "improve modern pricing and cost techniques." This project focuses on personnel training and retention and increasing the level of sophistication in the process through selective and cost-effective application of a time-sharing computer. The main objective of the project is to introduce computer technology to the contract pricing function as a medium for implementation of advanced analytical information processing and management techniques.

2. COPPER IMPACT: Computer Technology Applied to Contract Pricing

This report was sponsored by the Florida Institute of Technology and was written in 1980 by James E. Gustine, John A. Mills, and Charles R. Thompson of the Florida Institute of Technology. In 1980, the U.S. Army research and development community, specifically the U.S. Army Materiel Development and Readiness Command (DARCOM), began to use time-shared computer applications in their contract pricing. The objective of this report is to describe COPPER IMPACT and to relate its applicability to the DARCOM efforts to use time-shared computer applications in contract pricing.

3. Report on the Feasibility of Designing Expert Systems For Contract Price Analysis

This research was sponsored by the Air Force Business Research Management Center, Wright-Patterson Air Force Base (AFB), Ohio. The report was written in 1983 by Dr. B. Chandrasekaran, Dr. J. Dillard, Dr. T. Harrison, and Dr. K. Ramakrishna of Ohio State University. It discusses the feasibility of designing an expert system for contract price analysis. A prototype design in the ZOG[1] information management system is also presented. The system architecture and the organization of pricing knowledge in the system was determined by field investigations.

A final piece of literature that was discovered in a separate literature search was the article, "Contracting Office Information Systems: A Key to Defense Acquisition Improvement," which appeared in the February 1990 issue of Contract Management, the professional journal of the NCMA. This article discusses the emergence of contracting automation technology, presents some current examples of DOD procurement related automated systems, surfaces some problem areas, and addresses positive trends.

C. PRIOR RESEARCH

1. COPPER IMPACT

During the late 1960's and early 1970's the Air Force procurement community had considerable concerns. The principal concerns were [Ref. 6:p. 1-1]:

- The increasing complexity of weapon systems which was leading to serious cost growth problems;
- Cost growth problems were undermining public and Congressional confidence in Air Force management of the procurement process;

[1]ZOG is not an abbreviation. The name was selected for its ease of pronunciation and novelty, and is intended to suggest that ZOG is a novel system for human-computer interactions. The ZOG system was developed at Carnegie-Mellon University, supported by the Office of Naval Research.

- National resources were beginning to be allocated to projects other than defense, causing a scarcity of funds;

- Budget cuts, weapon system complexity and Congressional acts, such as Public Law 87-653, Truth in Negotiations, created a need for increased detail in data and analysis associated with establishing weapon contract prices.

In late 1971 [Ref. 6:p. 1-2], the Director of Air Force Procurement Policy, then Brigadier General R.F. Trimble, responded to these concerns by initiating a project, COPPER IMPACT, to Improve Modern Pricing and Costing Techniques. The project was approved by the Air Force Chief of Staff on 9 May 1972 [Ref. 6:p. 1-2].

The objective of COPPER IMPACT was to improve the Air Force's ability to procure what it needed at realistic, fair and reasonable prices. The approach was to enlarge and refine the judgment-making capacity of professional procurement pricing personnel. This would be done by streamlining the administrative and mechanical tasks in the pricing process. This would provide the analyst with more time, information, and techniques to accomplish the primary pricing objective of obtaining the best price for the Government.

During 1972 [Ref. 6:p. 1-2], the primary goal was to develop the automated system necessary to support the objectives of COPPER IMPACT. Time-sharing computers had been used in field pricing activities successfully since 1969 [Ref. 6:p. 1-2] in applying the overhead cost forecasting technique known then as PIE-COST (Probability of Incurring Estimated Cost). The decision to merge PIE-COST into the COPPER IMPACT project was made in late 1972 [Ref. 6:p. 1-2]. This merger formed the nucleus of the network of time-sharing computer users involved in contract pricing and financial analysis. The resulting system provided for the development of cost proposal simulation models, data banks of pricing information, such as labor and overhead rates, and analytical programs, such as regression analysis. The program is written in the FORTRAN programming language for implementation on a General Electric (GE) Time Share computer using the GE-Timeshare operating system.

Cost models contain logic simulation which can model any contractor's proposal by simulating the proposal's inherent logical buildup and cost relationships. The analyst, using this model, can quickly audit the proposal, compute a negotiation objective based on the results of his analysis, recompute a position during negotiations and present all cost proposal analysis in formatted hard-copy spreadsheets. These models permit the analyst to perform sensitivity analysis through the use of a series of model runs. Then, determination of which cost elements drive the bottom line price can be accomplished. "The various cost models have shown a savings from 8:1 to 10:1 in terms of man-hours consumed in pricing computations and report operations, while being very useful in all aspects of the pricing process." [Ref. 7:p. 4]

There are three types of cost models available [Ref. 7:p. 3]:

- Generalized Cost Model (GCM);
- Programmable Cost Model (PCM);
- Management of Overhead Discrete Evaluation (MODE).

GCM permits the user to construct a model of a specific proposal without knowledge of any programming language. Its main utility is in reducing the time required to program the model in BASIC or FORTRAN.

The purpose of PCM is identical to GCM, but it uses an approach where the user interacts conversationally with the program when defining the model and putting data in. COPPER IMPACT users have programmed many specialized models to apply to specific cost proposal formats from different contractors.

MODE examines the overhead cost flow from initial cost occurrence to a final rate of development by simulating a specific contractor's cost accounting system. Settled Overhead Retrieval Technique (SORT) complements MODE by providing the Administrative Contracting Officer (ACO) data on final settlement findings by various contract administrative activities over the last three years. This model helps lend to the consistency of the treatment of overhead rates.

In addition to cost models, COPPER IMPACT provides four other major applications:

- Workload Management;
- Data Banks;
- Analysis Aids;
- Financial Data Retrieval and Analysis System (FINANDAS).

Workload management provides local management, internal management and higher headquarters visibility of caseload and management information to assist in resource allocation decisions, overall management decisions, and policy decisions.

The primary data bank application in COPPER IMPACT is the centralized pricing rate and factor data bank, CONRATES. The time-sharing computer allows for central storing, maintaining, and retrieval of information by users at widely dispersed locations.

In addition to the previously mentioned applications, COPPER IMPACT provides numerous ways to assist in the analysis of large quantities of data. Statistical analysis, curve-fitting, regression, correlation, learning curves, cash flow, and present value analysis are some of the examples of the analysis aids available.

FINANDAS is a recent addition to COPPER IMPACT. It has the capability of obtaining and analyzing financial statements of major defense contractors. The system was developed by the Logistics Management Institute (LMI) under the sponsorship of DOD, Director of Contracts and Systems. FINANDAS stores financial statements from up to 900 defense contractors. If the contractor's financial statement is not stored, FINANDAS has the capability of analyzing the financial statement if the data are entered by the user. Stored data are obtained from Standard and Poor's Compustat Services, Inc. and includes 133 elements of audited annual financial data, five-year financial statements, historical trends, several ratio reports, and the capability to produce five-year projections. [Ref. 7:p. 6]

COPPER IMPACT met the expectations of the Air Force's program and was expanded in subsequent years with sophisticated applications and models. Since 1974 [Ref. 7:p. 2], other government agencies in DoD have become subscribers to the program.

The Army became interested in the computer time-shared technique of contract pricing for the same reasons as the Air Force. Army Materiel Command (AMC) placed three computer terminals on-line with the COPPER IMPACT network in July 1977 [Ref. 7:p. 2]. These were located in the Missile Command, Tank-Automotive Command, and Armaments Material Readiness Command. Since that time the service has been expanded to 11 terminals which provide time-shared capability with all major subordinate commands of AMC and two AMC offices located in major defense contractors' plants.

2. Time-share Computer Systems

A time-share computer system is one which organizes and directs multiple access to a single central processing unit. Through the use of telephone communication equipment, the user can be away from the location of the central computer.

There are five general areas that time-share computer systems have application in:

- Data Banks;
- Overhead Management;
- Cost Models;
- Workload Management;
- Statistical Analysis.

Some time-share programs currently written are discussed below [Ref. 8:p. 24].

a. A Systematic Numerical Analysis of Proposals Program (ASNAPP)

ASNAPP allows comparison of up to six different cost proposals against one base. It calculates cost element variances and prints formatted reports.

b. Proposal/Position Comparison Program (POPICOP)

POPICOP calculates and displays the contractor's proposal, the corresponding Government estimate, and the computation of variances between the two.

c. WGL

This program generates a Weighted Guidelines Profit Objective consistent with the DoD Profit Policy.

3. Report on the Feasibility of Designing Expert Systems for Contract Price Analysis

This is a technical report containing conclusions about the feasibility of "expert systems" for price analysis. The report also analyzes contract pricing. Problems associated with price analysis during procurement are identified as well.

The design of a prototype in an information base called XINFO[2] is then presented. Some of the problems with this design are discussed. A proposed redesign using another information base called ZOG is provided, along with how an expert system could improve performance among both trained and untrained personnel.

The focus of this study was the development of a prototype version of an "intelligent" computer system designed to aid in price analysis. An "intelligent" system is an interactive computer system that does not have problem-solving capabilities, but is intended to guide a user to performing at an expert level.

The model was designed to perform all aspects of price analysis as described in the ASPM-1. The main objective was to construct a system that could be used by an unskilled, inexperienced analyst to make complex calculations, thereby greatly assisting in the procurement process, as well as potentially saving the Government large sums of money.

The simplest level is an on-line reference manual that would point the user to information that might be needed. The second level, similar to COPPER IMPACT, could provide spreadsheet capability that would help collect and manipulate data as well as offer simulation models. The next level

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[2]This is not an abbreviation. The name is intended to suggest that it is an extended information base. The XINFO system was developed at the Massachusetts Institute of Technology.

provides a series of questions and answers to assist the user in using information stored in a database. A structured trace of the user responses to the questions can be used to construct a descriptive model of the contractor's bid. The highest and most sophisticated level is capable of constructing normative models of the contractor's bid based on the descriptive models.

The conclusions at the time of the report were basically two-fold. The expert system was too cumbersome at the time, but its potential usefulness warranted further research.

4. <u>The Institute for Defense Analyses Cost Research Symposium</u>

The Institute for Defense Analysis (IDA), Alexandria, Virginia, conducted a meeting on 18 May 1989 to discuss studies on cost research. Participants included the directors of offices that sponsor and conduct defense cost research. A report was prepared by the Cost Analysis and Research Division of IDA. The report catalogues studies discussed at the meeting.

The focus of the meeting was identification of research activities and information that were not otherwise available through DTIC and NTIS. Studies were identified that had just been completed, were in progress, or planned. The report contains a general overview of the 209 research tasks discussed during the symposium. About 84 percent of the studies deal with some aspect of cost estimating/analysis.

About 14 percent deal with other techniques for reviewing/ monitoring costs. [Ref. 9:pp. 1-4]

5. "Contracting Office Information Systems: A Key to Defense Acquisition Improvement"

This article, written by James L. Vann, appeared in the February 1990 issue of Contract Management, the professional magazine of the NCMA. It discusses the emergence of contracting automation technology in three distinct areas:

- Powerful microcomputer hardware based on faster microprocessor chips and operating systems, and greater memory and data storage;
- Integrated fourth generation software oriented toward the end user;
- Advanced architectures and protocols for electronic data interchange networks and system connectivity.

Some potential applications are listed as follows:

- Advanced office automation systems;
- Integrated database networks;
- On-line vendor communications;
- On-line regulatory guidance;
- Interactive computer-based instruction;
- Decision support systems.

Nine current DOD procurement related automated systems are described.

a. DLA Pre-Award Contracting System (DPACS)

This system, prototyped in 1986 at the Defense Industrial Supply Center in Philadelphia, Pennsylvania, automates large-scale supply purchasing operations. It has the capability of retrieving price histories and other purchasing information required by buyers on solicitations.

b. Paperless Order Placement System (POPS)

Initiated in 1983 at the DLA Defense General Supply Center in Richmond, Virginia, this system electronically places orders with established vendors for standard supply items.

c. Mechanization of Contract Administration Services (MOCAS)

This system is the primary mainframe-based system for tracking the status of DCMS sites' contract administration.

d. Integrated Procurement System (IPS)

This system enhancement is expected to replace the Army Materiel Command's current contract drafting system, Procurement Automated Data and Document System (PADDS). Some of the systems features include:

- Electronic transmission of requirements and procurement documents within the command matrix;
- Support for developing independent Government cost estimates;
- Electronic transmission of synopses, solicitations, proposals, and contracts.

e. Standard Army Automated Contracting System (SAACONS)

Acquired by the Army in 1987, this system has been fielded in more than 150 installation contracting offices. SAACONS is menu-driven and is functionally oriented toward desktop preparation of contract documents and reports. It is designed for non-major systems and installation level support contracting.

f. Automation of Procurement and Accounting Data Entry (APADE)

This system, maintained by the Navy's FMSO, features on-line retrieval of price histories and vendor sources, action status, forms and report generation, and standard item descriptions. Enhancements include word processing, document preparation, automated bidders lists, and bid evaluation packages.

g. Base Contracting Automated System (BCAS)

This Air Force system for installation contracting, adopted by the Marine Corps and the Defense Mapping Agency as well, emphasizes electronic transmission and validation of requirements, history data, reports generation, and updates to requiring and finance activities.

h. Acquisition Management Information System (AMIS)

This mainframe system developed by the Air Force provides integrated financial status tracking and administration of major systems and related contracts.

i. Contract Data Management System (CDMS)

This is another Air Force system that is planned for the 1990's. Its features are supposed to include receiving and processing procurement requests, document preparation, proposal evaluation, price history retrieval, report generation, and extensive system interconnectivity.

Next, the article surfaces five problem areas:

- Failure to address contracting needs;
- System proliferation;
- Excessive standardization;
- Program cost and grandiosity;
- Management coordination.

Finally, it addresses some positive trends. For instance, DOD has developed the Defense Interdepartmental Procurement Automation Control Council (DIPACC), an office within the Secretary of Defense, which will serve as an advisory panel to the Deputy Assistant Secretary of Defense (Procurement) on policy matters relating to the procurement of automation systems. Additionally, the Office of Federal Procurement Policy (OFPP) is sponsoring an interagency task force to support a project on procurement automation for the President's Council on Management Improvement.

D. SUMMARY

This chapter provided background information concerning the preliminary research that was conducted and presented a review of related research done by others in this area.

The next chapter furnishes a functional description of the proposed framework for a standard, stand-alone, computerized contract pricing model.

III. THE PROPOSED MODEL

A. PURPOSE

The purpose of this chapter is to furnish a functional description of the proposed framework for a standard, stand-alone, computerized contract pricing model. An overview, methodology, context diagram, and data flow diagrams are provided in order to understand the proposed model and lay the groundwork for analyzing the practicability of developing such a model.

B. OVERVIEW

The proposed model is not intended to be used for cost/price analysis. It is designed only to calculate price positions relative to the Government, the contractor, and the current negotiated position. All costs/prices are assumed to have been analyzed prior to being input into the model using various techniques available.

A standard, stand-alone, computerized contract pricing model that calculates contract prices and fall-back positions would be extremely advantageous and has tremendous potential because the price analyst and negotiator would not have to "reinvent the wheel" when preparing price proposals and conducting price negotiations. The contract negotiator would be able to almost instantaneously recalculate the current negotiated position in relation to a predetermined negotiation range and the contractor's price position.

C. METHODOLOGY

In order to understand the information requirements and conceptualize how data moves through the proposed model, what processes transform data and what the outputs are, a visual depiction will be provided along with a narrative description of the proposed model. The presentation of the proposed model will take the form of a series of data flow diagrams and the appropriate explanations to accompany them.

Data flow diagrams are a graphical representation of data movement through the proposed model. The data flow approach emphasizes the logic underlying the proposed model. By using a combination of only four symbols, as depicted in Figure 1 (Data Flow Diagram Symbols), a pictorial depiction of data flows is created.

The shadow-box is used to depict an external entity that can give and receive data from the system. The external entity is also called a source or destination of data, and is considered to be external to the study. Each external entity is labeled with an appropriate name. Although it interacts with the system, it is considered as external to the boundaries of the system.

The arrow shows movement of data from one point to another, with the head of the arrow pointing toward the data's

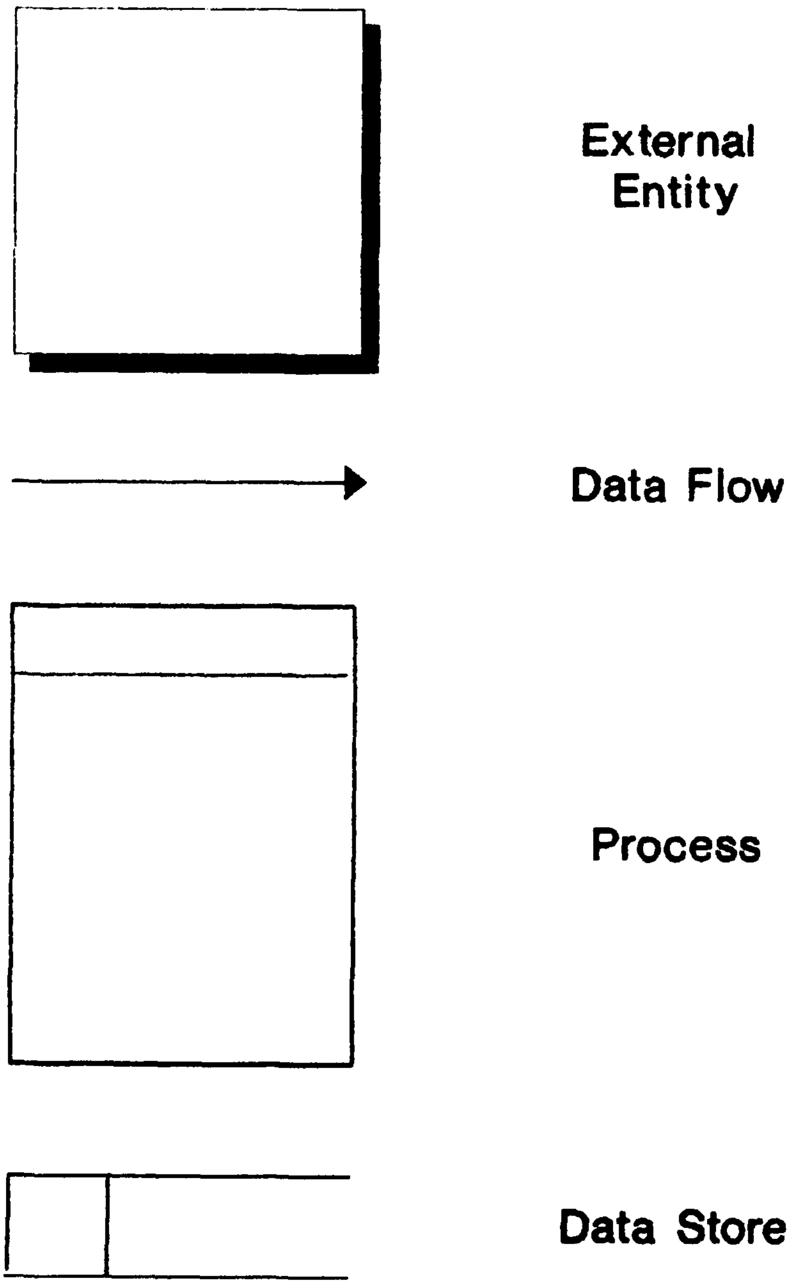

Figure 1. Data Flow Diagram Symbols

destination. Each arrow is labeled with an appropriate data flow name.

A regular box is used to show the occurrence of a transformation process. Processes always denote a change in or transformation of data. Hence, the data flow leaving a process is always labeled differently than the one entering it.

The last symbol used in data flow diagrams represents a data store and is an open-ended rectangle. Each data store is labeled with an appropriate name. In data flow diagrams, the type of physical storage (e.g., tape, diskette, etc.) is not specified.

The data flow approach has three advantages [Ref. 10:p. 249]. The biggest advantage is the conceptual freedom found in the use of the four symbols. None of the symbols specifies the physical aspects of implementation.

An additional advantage is that it enables the reader to better understand the interrelatedness of the proposed model and its process by providing a broad overview and then exploding the proposed model into its functional subsystems.

A third advantage is that it can be used as a tool to interact with users. By showing them representations of the proposed model, users can comment on the accuracy of the conceptualization.

Developing the data flow diagrams was accomplished by using the top-down approach. First, the data flows were conceptualized from a top-down perspective. A context diagram was drawn. It determines the boundaries of the proposed model to be described.

Next is the level zero diagram which is an overview of basic inputs, processes, and outputs. This is the most general diagram and is a bird's eye view of the broadest possible conceptualization of the proposed model.

The diagrams move from general to specific. More details are subsequently added at levels two and three by exploding the diagrams.

D. CONTEXT DIAGRAM

The standard, stand-alone, computerized contract pricing model could be used for preparing contract price proposals or during contract price negotiations, as depicted by the context diagram in Figure 2 (Context Diagram).

E. DATA FLOW DIAGRAMS

1. Level Zero

The level zero data flow diagram is depicted in Figure 3 (Level Zero). There are only two entities throughout the entire proposed model. One is the Government contract price analyst/negotiator and the other is the defense contractor.

There are three basic processes in the proposed model:

- Calculate the Government's price proposal (Figure 3--Process 1);
- Calculate the defense contractor's price position (Figure 3--Process 2)

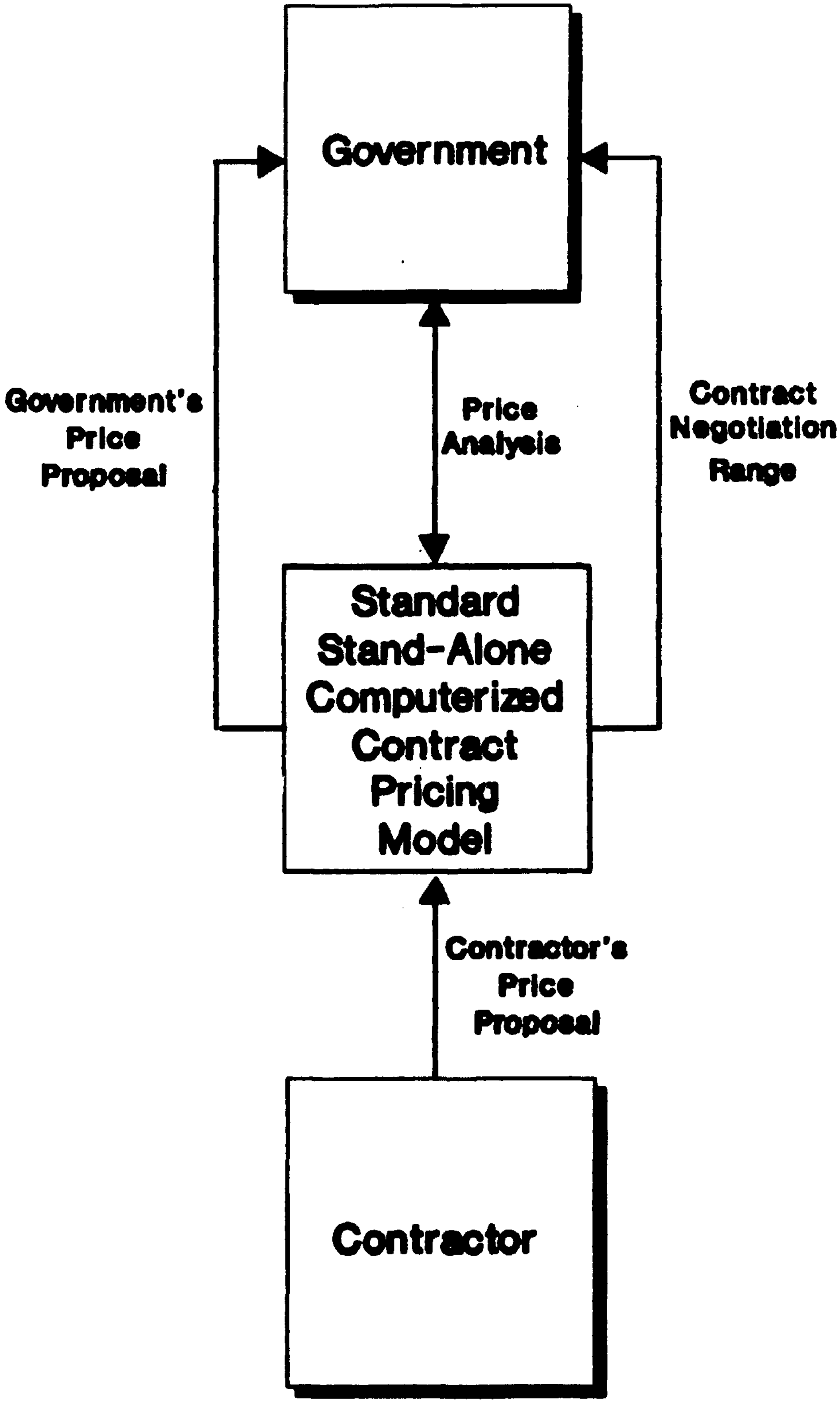

Figure 2. Context Diagram

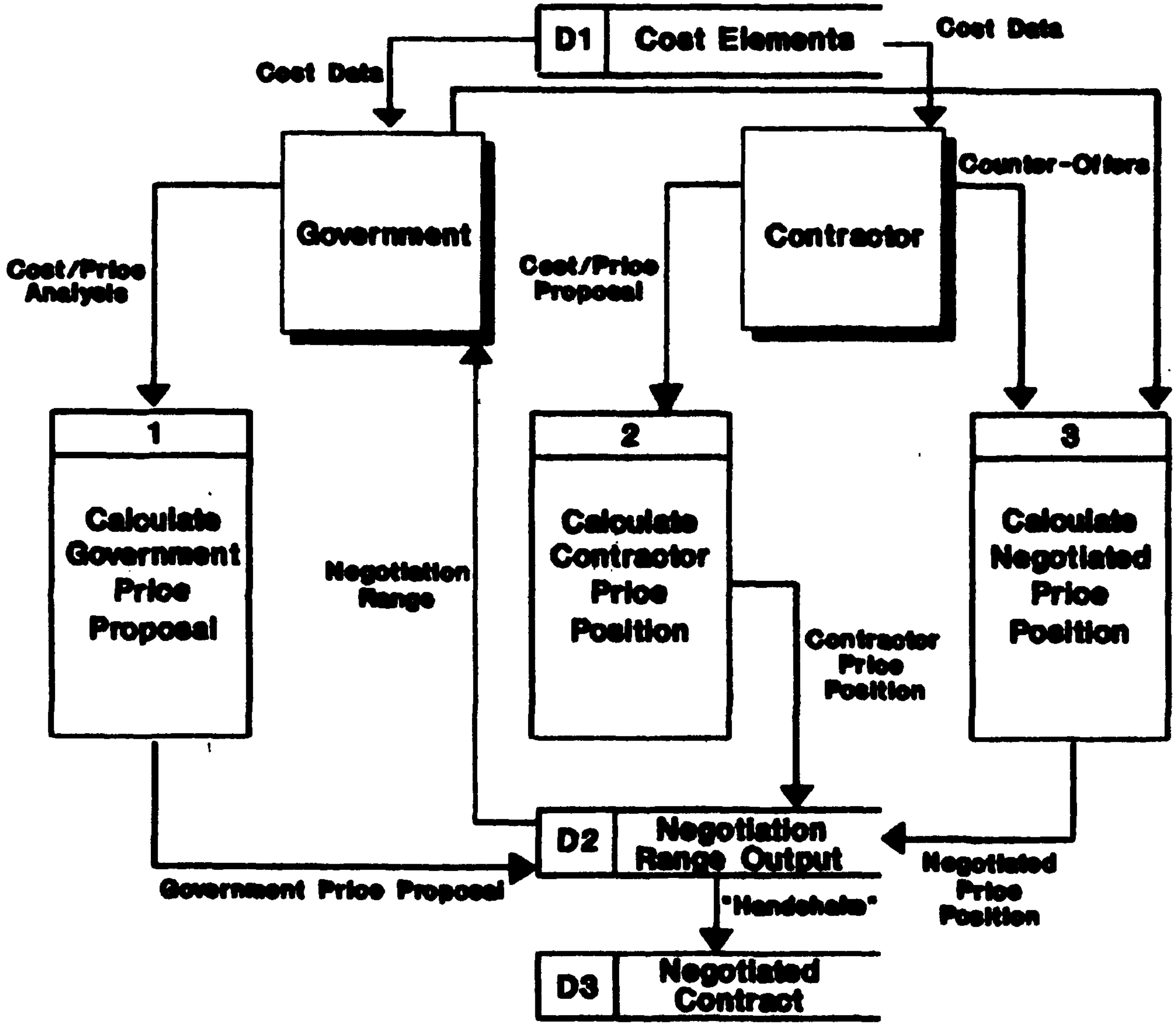

Figure 3. Level Zero

- Calculate the negotiated contract position (Figure 3--Process 3).

Data flow through several paths at this level. Cost/price analysis data by the Government contract price analyst/negotiator (Figure 3--Government Entity) of the applicable contract cost elements (Figure 3--Data Store 1) flow to the first process of the proposed model--calculate the Government's price proposal (Figure 3--Process 1). The Government's price proposal data flow to the contract negotiation range output (Figure 3--Data Store 2). Negotiation range output, at this point, are only the Government's minimum, objective and maximum starting price proposal positions. The information from the negotiation range output (Figure 3--Data Store 2) flows back to the Government contract price analyst/negotiator (Figure 3--Government Entity).

The defense contractor's (Figure 3--Contractor Entity) price proposal of the applicable contract cost elements (Figure 3--Data Store 1) flows to the second process of the proposed model--calculate the defense contractor's price position (Figure 3--Process 2). The defense contractor's price position flows to the contract negotiation range output (Figure 3--Data Store 2).

The Government's starting price proposal (based on Figure 3--Process 1) and the defense contractor's price position (based on Figure 3--Process 2) form the contract negotiation range which flows back to the Government contract price analyst/negotiator (Figure 3--Government Entity) as the contract negotiation range output (Figure 3--Data Store 2). This output provides the Government contract negotiator with his minimum, objective, and maximum positions, along with the contractor's proposed position.

Then, negotiated cost elements of counter-offers from the Government negotiator (Figure 3--Government Entity) and the defense contractor (Figure 3--Contractor Entity) flow to the third process of the proposed model--calculate the negotiated contract position (Figure 3--Process 3). At this point, the data flow to the contract negotiation range output (Figure 3--Data Store 2) and back to the Government contract price analyst/negotiator (Figure 3--Government Entity), where the present negotiated position is displayed alongside of the Government's minimum, objective, and maximum positions, and the contractor's position.

When this negotiated contract position is agreed upon and the "handshake" occurs, the data flow to the negotiated contract (Figure 3--Data Store 3).

Figure 4 (Level Zero Output) depicts what output at this level may look like. The output at this level is calculated by combining the level one data.

2. <u>Level One</u>

The level one drawings are depicted in Figures 5 (Calculate Government Price Proposal), 6 (Calculate Contractor Price Position), and 7 (Calculate Negotiated Contract Position). At this level, calculation of the Government's

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
DIRECT COSTS					
DIRECT MATERIALS					
DIRECT LABOR					
OTHER DIRECT COSTS					
	----------	----------	----------	----------	----------
SUBTOTAL					
INDIRECT COSTS					
OVERHEAD					
	----------	----------	----------	----------	----------
SUBTOTAL					
G & A					
	==========	==========	==========	==========	==========
TOTAL COST					
PROFIT					
	==========	==========	==========	==========	==========
TOTAL PRICE					

Figure 4. Level Zero Output

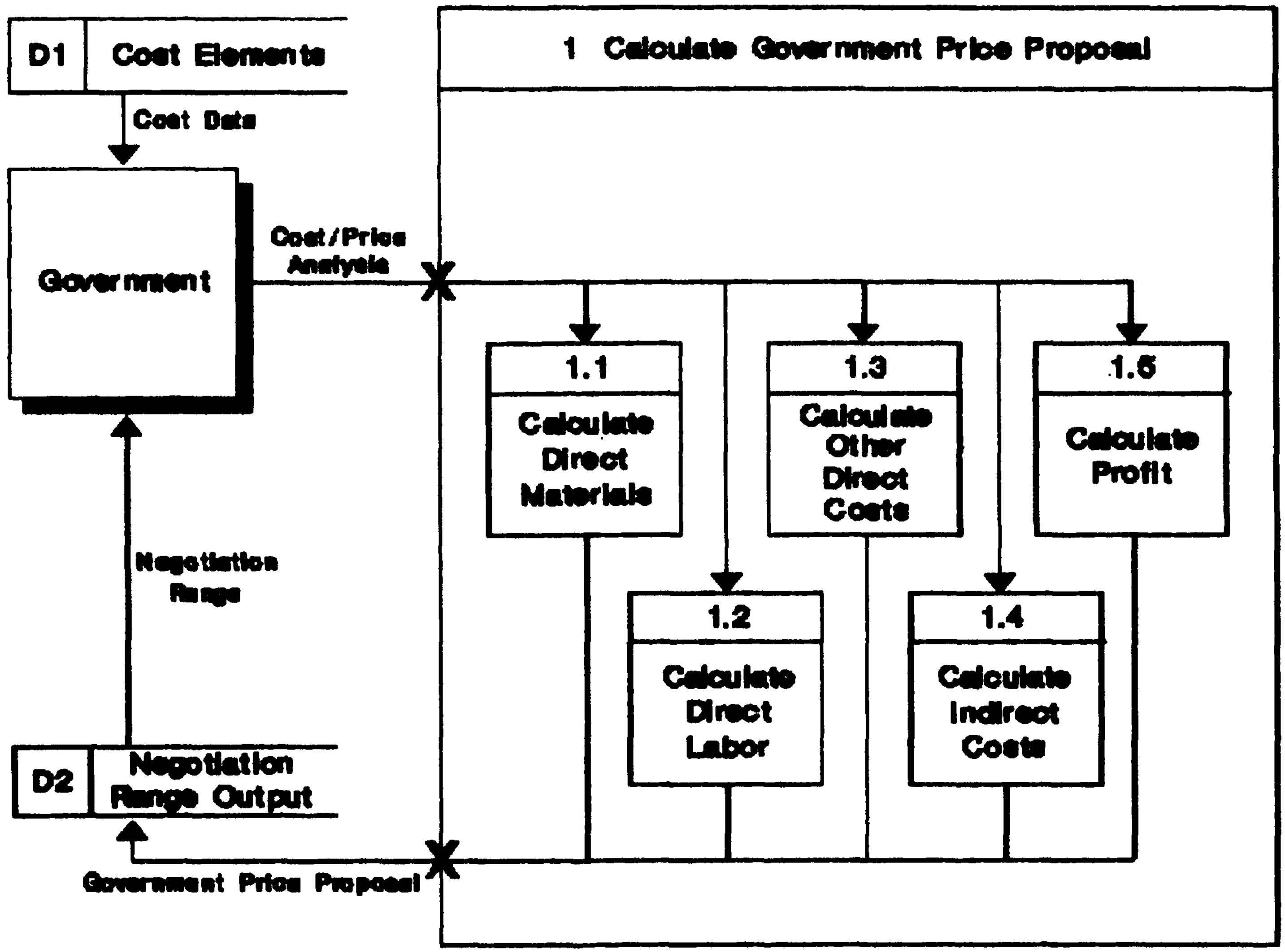

Figure 5. Calculate Government Price Proposal

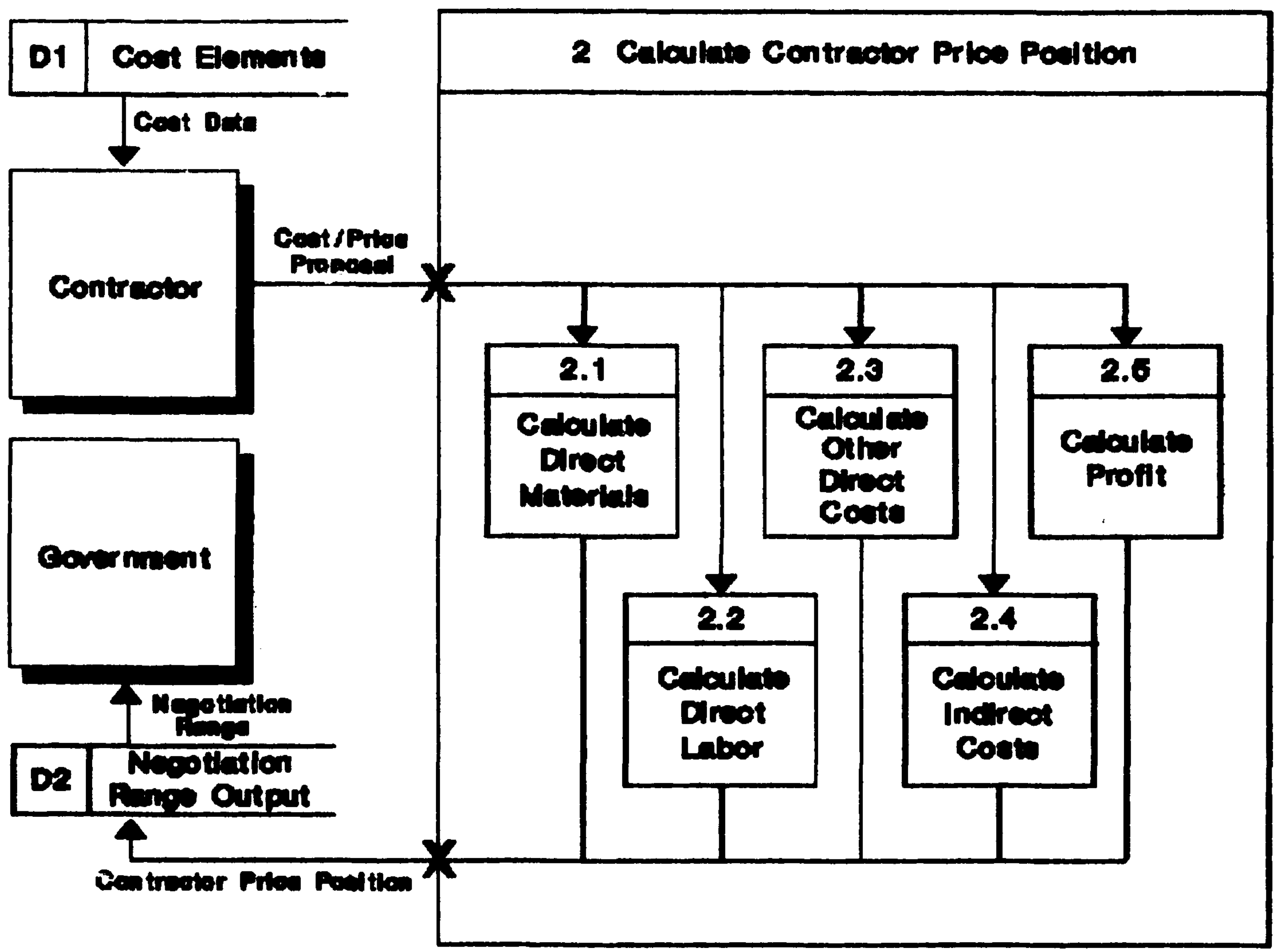

Figure 6. Calculate Contractor Price Position

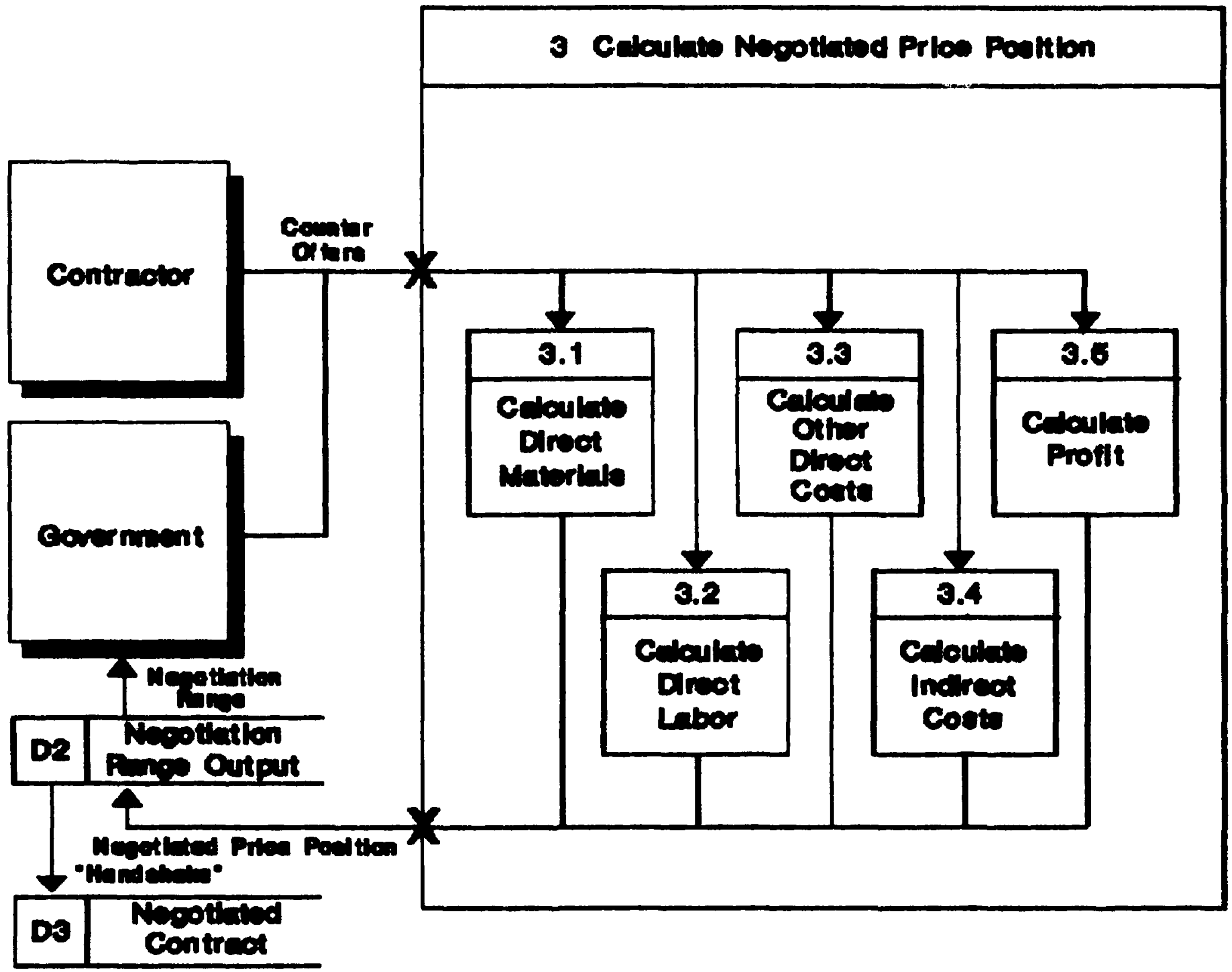

Figure 7. Calculate Negotiated Contract Position

contract price proposal, the defense contractor's price position, and the negotiated contract position are all performed by five subsystems:

- Calculate Direct Materials (Figure 5--Process 1.1)(Figure 6--Process 2.1)(Figure 7--Process 3.1);
- Calculate Direct Labor (Figure 5--Process 1.2)(Figure 6 --Process 2.2)(Figure 7--Process 3.2);
- Calculate Other Direct Costs (Figure 5--Process 1.3) (Figure 6--Process 2.3)(Figure 7--Process 3.3);
- Calculate Indirect Costs (Figure 5--Process 1.4)(Figure 6--Process 2.4)(Figure 7--Process 3.4);
- Calculate Profit (Figure 5--Process 1.5)(Figure 6--Process 2.5)(Figure 7--Process 3.5).

The output at this level would look the same as the output for level zero (Figure 4--Level Zero Output), but is calculated from level two data input.

3. Level Two

At this level, the five subsystems that calculate the Government's contract price proposal, the defense contractor's price position, and the negotiated contract position are exploded into their own subsystems.

Since the calculation processes for the five level one subsystems (Figure 5--Processes 1.1, 1.2, 1.3, 1.4, & 1.5) (Figure 6--Processes 2.1, 2.2, 2.3, 2.4, & 2.5)(Figure 7--Processes 3.1, 3.2, 3.3, 3.4, & 3.5) are the same for the Government's contract price proposal, the defense contractor's price position, and the negotiated contract position, only the data flow diagrams for the calculation of the Government's contract price proposal will be portrayed (Figure 3--Process 1).

a. Calculate Direct Materials (Figure 8--Process 1.1)

Calculation of direct materials is performed by five subsystems, as depicted in Figure 8 (Calculate Direct Materials):

- Calculate Raw Materials (Figure 8--Process 1.1.1);
- Calculate Subcontracted Items (Figure 8--Process 1.1.2);
- Calculate Standard Items (Figure 8--Process 1.1.3);
- Calculate Interorganizational Transfers (Figure 8--Process 1.1.4);
- Calculate Purchased Parts (Figure 8--Process 1.1.5).

The output for each of the five subsystems (Figure 8--Processes 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5) within the process of calculating direct materials (Figure 8--Process 1.1) is derived from level three data input. The output for the process of calculating direct materials is calculated by adding the totals of the five subsystems (Figure 8--Processes 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5) within the direct materials subsystem (Figure 8--Process 1.1).

Figure 9 (Direct Materials Output) depicts what the output that the user would receive from the direct materials subsystem (Figure 8--Process 1.1) may look like.

For example, the total minimum costs of raw materials, subcontracted items, standard items,

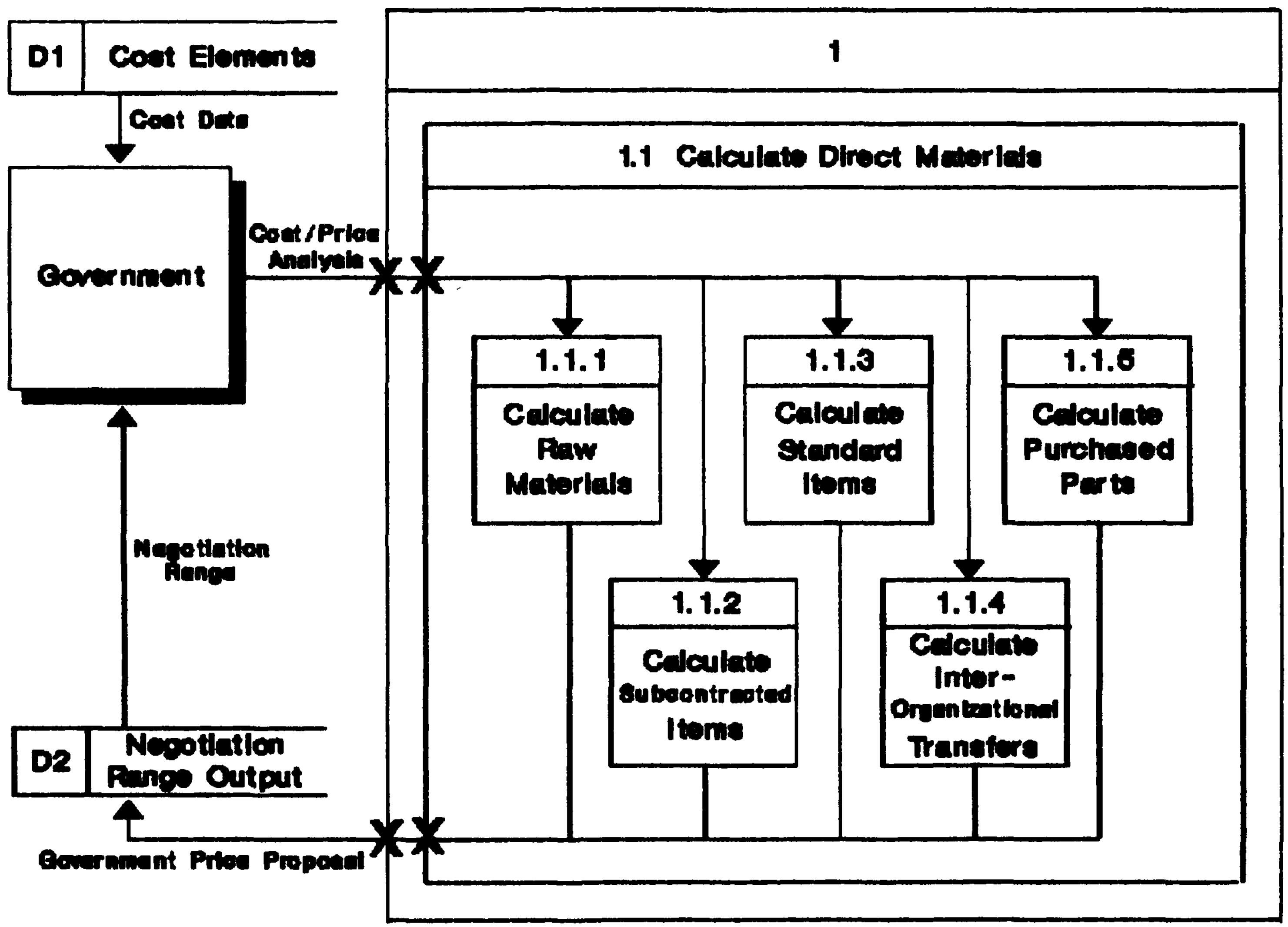

Figure 8. Calculate Direct Materials (Process 1.1)

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
RAW MATERIALS					
SUBCONTRACTED ITEMS					
STANDARD ITEMS					
INTERORGANIZATIONAL TRANSFERS					
PURCHASED PARTS					
	==========	==========	==========	==========	==========
TOTAL DIRECT MATERIALS					

Figure 9. Direct Materials Output

interorganizational transfers, and purchased parts are added, yielding the total minimum cost for direct materials.

b. Calculate Direct Labor (Figure 10--Process 1.2)

Calculation of direct labor is performed by two subsystems, as depicted in Figure 10 (Calculate Direct Labor):

- Calculate Factory Labor (Figure 10--Process 1.2.1);
- Calculate Engineering Labor (Figure 10--Process 1.2.2).

The output for each subsystem (Figure 10--Processes 1.2.1 & 1.2.2) within the process of calculating direct labor (Figure 10--Process 1.2) is derived from level three input. The output for the direct labor subsystem (Figure 10--Process 1.2) is calculated by multiplying the direct labor rates from level three by the estimated direct labor hours from level three and then summing the data.

Figure 11 (Direct Labor Output) depicts what the output that the user would receive from the direct labor subsystem may look like.

For example, the minimum direct labor rates for a particular labor category from level three are multiplied by the minimum estimated direct labor hours for that category from level three. The objective, maximum, contractor, and negotiated direct labor are calculated in the same manner. This process is repeated for each direct labor category. Then, the individual direct labor category costs, as calculated above, are summed, thereby providing total minimum,

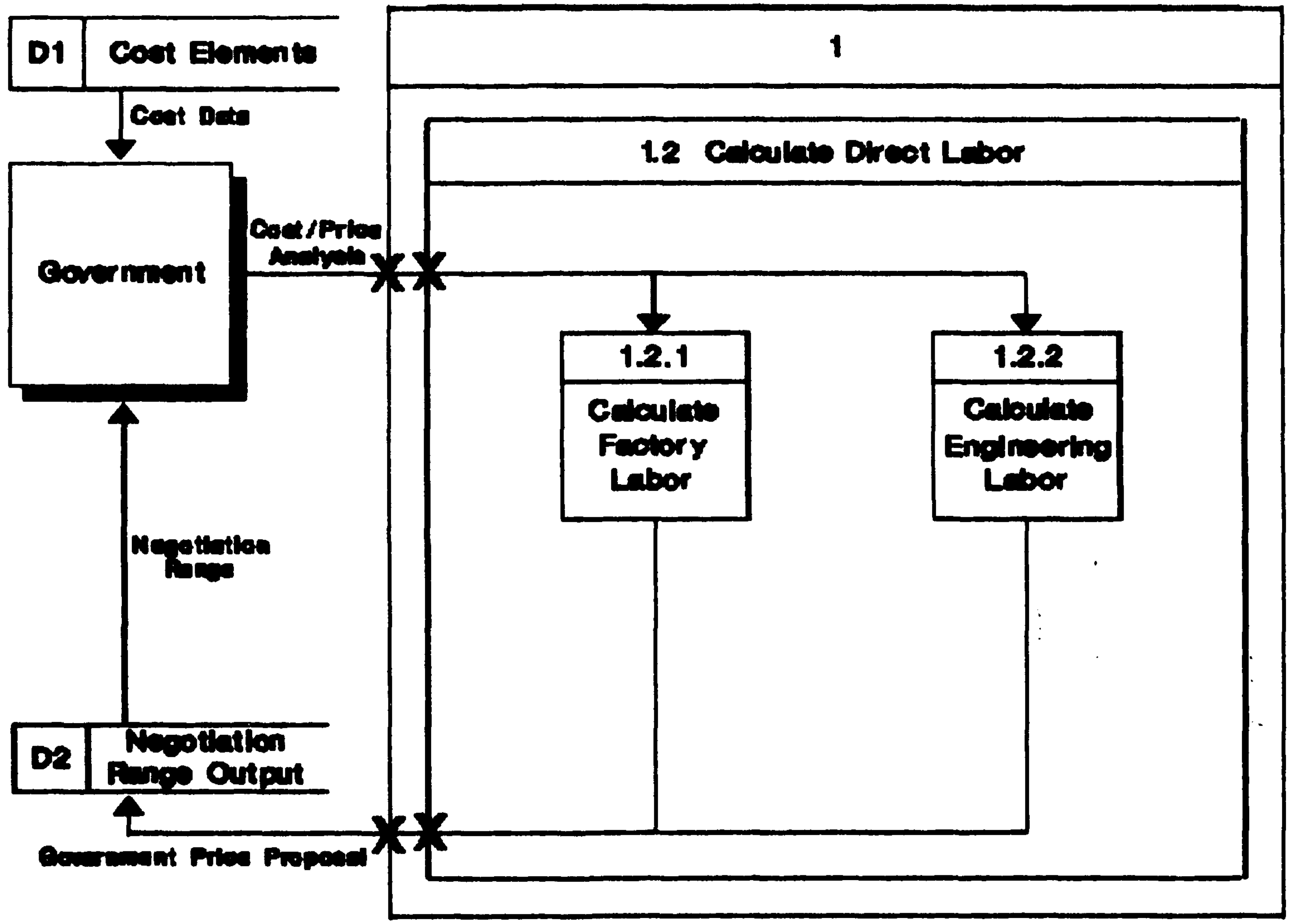

Figure 10. Calculate Direct Labor (Process 1.2)

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
FACTORY LABOR					
LABOR CATEGORY					
MACHINE					
ASSEMBLY					
TEST					
SUBTOTAL	----------	----------	----------	----------	----------
ENGINEERING LABOR					
LABOR CATEGORY					
DESIGN					
DRAFTING					
AERONAUTICS					
SUBTOTAL	----------	----------	----------	----------	----------
TOTAL DIRECT LABOR	==========	==========	==========	==========	==========

Figure 11. Direct Labor Output

objective, maximum, contractor, and negotiated direct labor costs.

c. Calculate Other Direct Costs (Figure 12--Process 1.3)

Calculation of other direct costs is performed by an unprescribed number of subsystems, as depicted in Figure 12 (Calculate Other Direct Costs). Examples of other direct costs are tooling, special insurance, travel expenses, preservation, packaging and packing, plant rearrangement, start-up costs, consultant's fees, certain clerical salaries, shop supplies, transportation costs, plant protection, royalties, excise taxes, computer expenses, and telephone and telegraph expenses [Ref. 1:p. 5-59].

The output at this level is calculated by adding total other direct costs (Figure 12--Processes 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.5, & 1.3.X) from level three data input.

Figure 13 (Other Direct Costs Output) depicts a possible output that the user may receive from the other direct cost subsystem.

For example, total minimum tooling, total minimum operating expense, total minimum tires and tubes, total minimum oil and grease, and total minimum equipment rental would be added yielding the total minimum other direct cost.

d. Calculate Indirect Costs (Figure 14--Process 1.4)

Calculation of indirect costs is performed by an unprescribed number of subsystems, as depicted in Figure 14

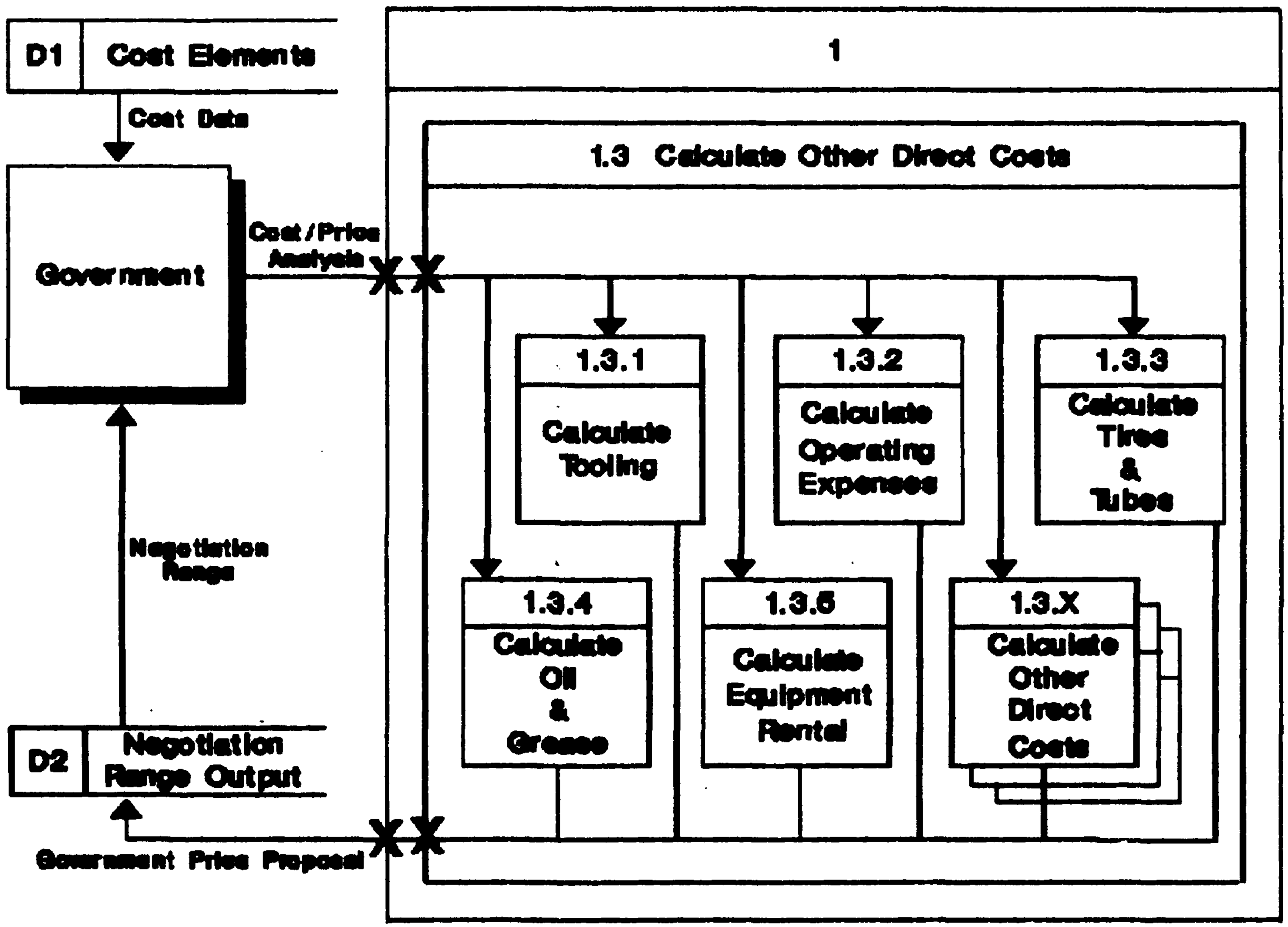

Figure 12. Calculate Other Direct Costs (Process 1.3)

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
OTHER DIRECT COSTS					
TOOLING					
OPERATING EXPENSE					
TIRES AND TUBES					
OIL AND GREASE					
EQUIPMENT RENTAL					
	==========	==========	==========	==========	==========
TOTAL OTHER DIRECT COSTS					

Figure 13. Other Direct Costs Output

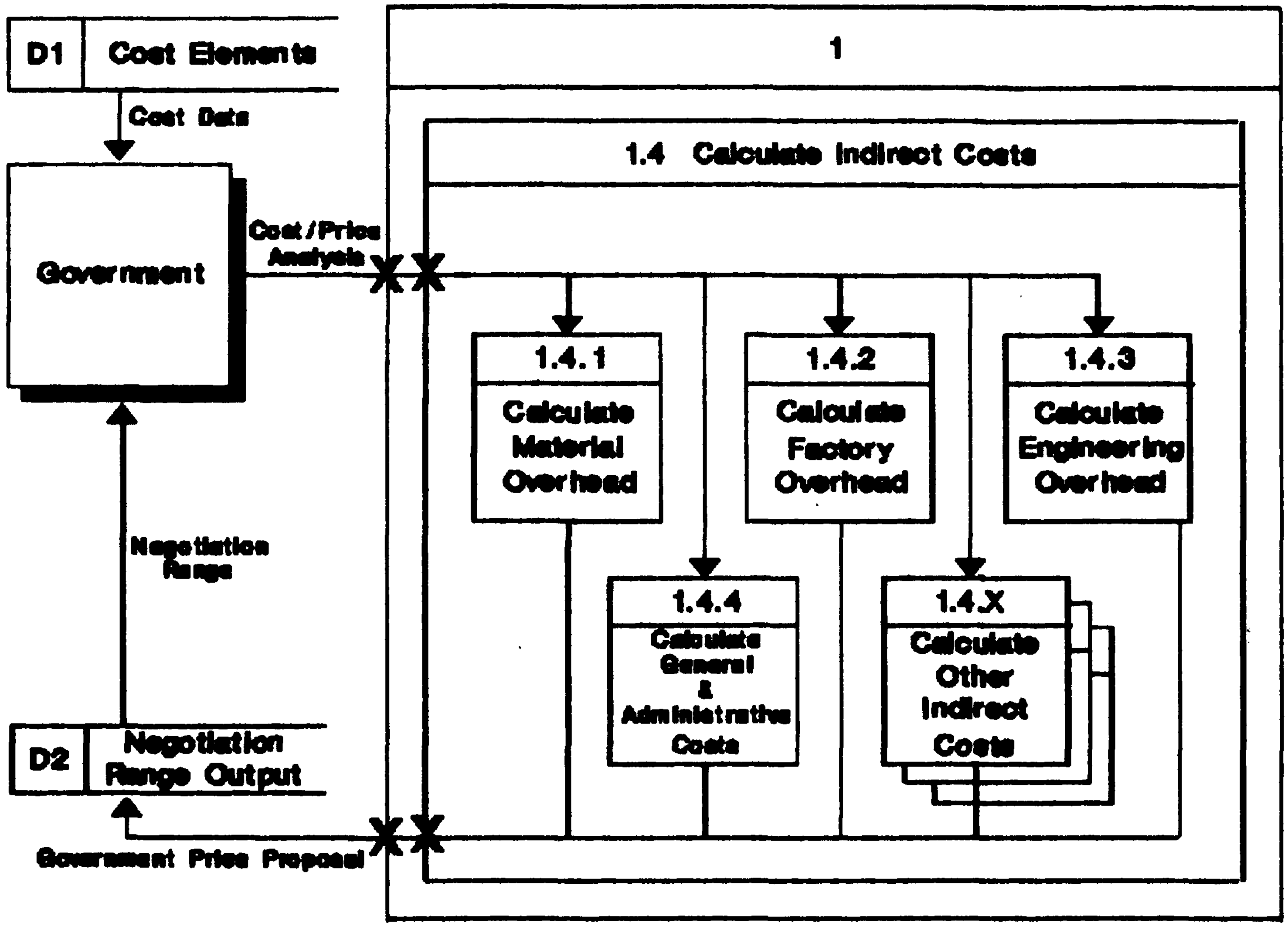

Figure 14. Calculate Indirect Costs (Process 1.4)

(Calculate Indirect Costs). Indirect costs can be comprised of an unlimited number of overhead expense pools. Overhead expense pools, other than those depicted, include, but are not limited to, scrap, spoilage, defective items, handling, and carrying costs.

The output for each subsystem (Figure 14--Processes 1.4.1, 1.4.2, 1.4.3, 1.4.4, & 1.4.X) within the process of calculating indirect costs (Figure 14--Process 1.4) is derived from level three input.

The output for the overhead subsystem is calculated by multiplying the overhead rates from level three by the estimated overhead bases from level three and then summing the data.

For example, the minimum overhead rates for a particular overhead category from level three are multiplied by the minimum estimated overhead base for that category from level three. The objective, maximum, contractor, and negotiated overhead are calculated in the same manner. This process is repeated for each overhead category. Then, the individual overhead category costs, as calculated above, are summed, thereby providing total minimum, objective, maximum, contractor, and negotiated overhead costs.

General and administrative costs are either input directly or they are calculated by multiplying the appropriate base, as derived from level three, by the applicable rate, thereby producing general and administrative costs.

Finally, the material overhead, factory labor overhead, engineering overhead, general and administrative expenses, and other indirect costs are summed, thereby providing total indirect costs.

Figure 15 (Indirect Costs Output) depicts what the output that the user would receive from the indirect cost subsystem may look like.

For example, the minimum material overhead, minimum factory labor overhead, minimum engineering overhead, and minimum general and administrative costs are added, yielding total minimum indirect costs.

e. Calculate Profit (Figure 16--Process 1.5)

Calculation of profit is performed by two subsystems, as depicted in Figure 16 (Calculate Profit):

- Weighted Guidelines Method (Figure 16--Process 1.5.1);
- Profit Base Method (Figure 16--Process 1.5.2).

The user may utilize one or both methods for calculating profit.

The output for the process of calculating profit using the weighted guidelines method (Figure 16--Process 1.5.1) is derived in accordance with DFARS Part 215, Subpart 215.9--Profit. This output would be produced five separate times from the level three data input, in order to yield the minimum, objective, maximum, contractor, and negotiated profit positions.

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
INDIRECT COSTS					
OVERHEAD					
MATERIAL					
FACTORY					
ENGINEERING					
	----------	----------	----------	----------	----------
SUBTOTAL					
G & A					
	==========	==========	==========	==========	==========
TOTAL INDIRECT COSTS					

Figure 15. Indirect Costs Output

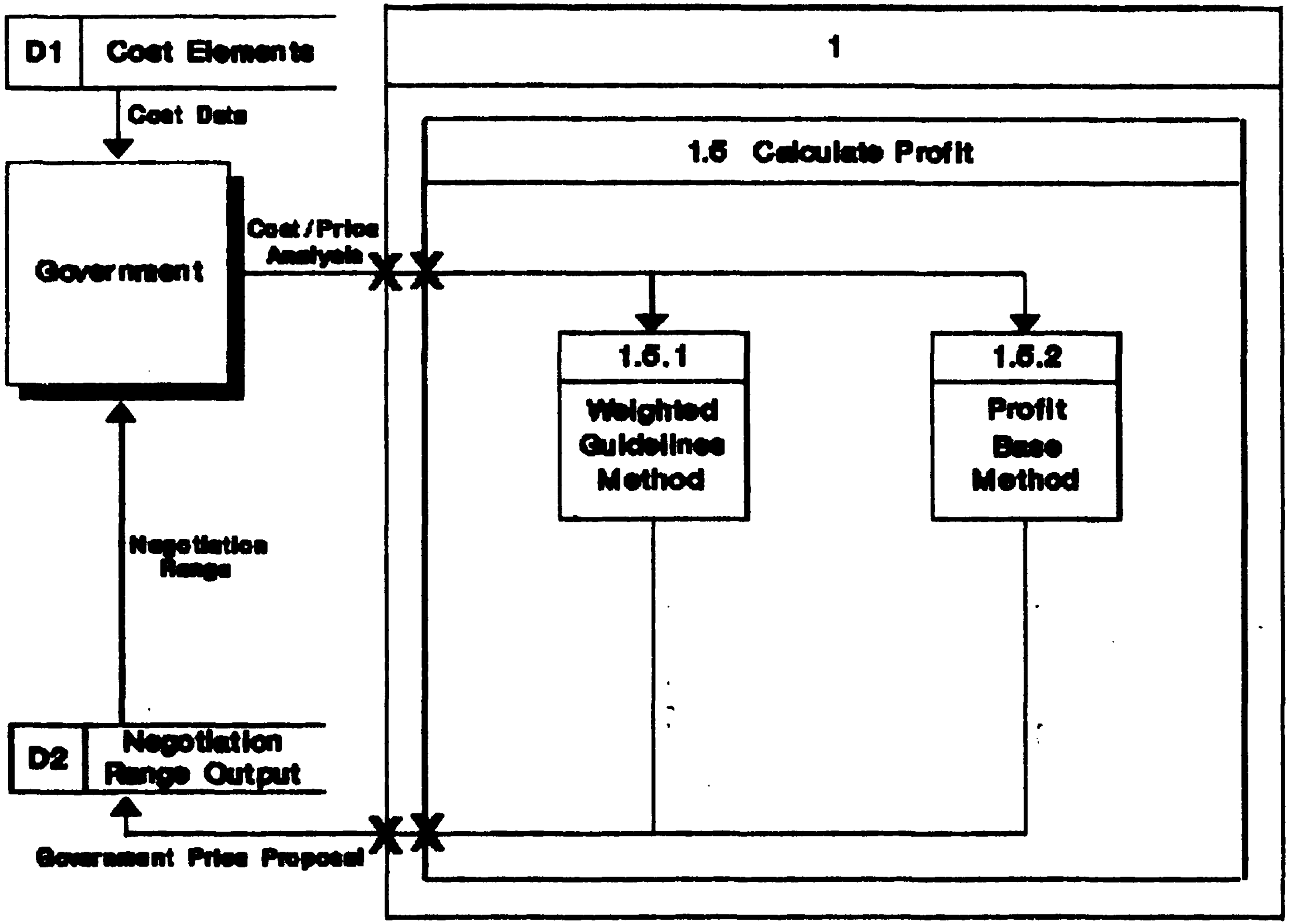

Figure 16. Calculate Profit (Process 1.5)

The output for the process of calculating profit using the profit base method (Figure 16--Process 1.5.2) is derived by taking the profit base from level three and multiplying it by the applicable rate, thereby producing the total profit.

Figures 17 (Weighted Guidelines Output) and 18 (Profit Base Output), the weighted guidelines method and the profit base method, respectively, depict what the output that the user would receive from the profit subsystem may look like.

For example, the minimum profit base is multiplied by the minimum percentage of profit, giving the minimum total profit.

4. <u>Level Three</u>

This is the level where the "rubber meets the road," so to speak. It is at this level where the majority of the data input for the contract is made.

a. Calculate Raw Materials (Figure 19-Process 1.1.1), Subcontracted Items, Standard Items, Interorganizational Transfers, and Purchased Parts

Figure 19 (Calculate Raw Materials) depicts the calculation of raw materials. Calculation of subcontracted items, standard items, interorganizational transfers, and purchased parts would be similar, therefore they are not shown. This process (Figure 19--Process 1.1.1) is performed by an unprescribed number of subsystems (Figure 19--Processes 1.1.1.1, 1.1.1.2, 1.1.1.3, & 1.1.1.X). Subsystems, other than

MATERIALS					
DIRECT LABOR					
INDIRECT COSTS					
OTHER DIRECT COSTS					

SUBTOTAL					
G & A					
	==========				
TOTAL COST					
CONTRACTOR RISK FACTOR	ASSIGNED WEIGHT	ASSIGNED VALUE	RISK	SUBTOTAL	PROFIT OBJECTIVE
TECHNICAL	.XX	.XX	.XX		
MANAGEMENT	.XX	.XX	.XX		
COST CONTROL	.X	.XX	.XX		
PERFORMANCE			.XX	XXXX	XXXX
CONTRACT TYPE			.XX	XXXX	XXXX
WORKING CAPITAL	COST FINANCED	LENGTH FACTOR	INTEREST RATE		
	XXXX	.XX	.XX		XXXX
	ASSIGNED VALUE	AMOUNT EMPLOYED			
LAND	.XX	XXXX			XXXX
BUILDING	.XX	XXXX			XXXX
EQUIPMENT	.XX	XXXX			XXXX
					==========
		TOTAL PROFIT OBJECTIVE			

Figure 17. Weighted Guidelines Output

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
PROFIT BASE					
PROFIT RATE					
	=========	=========	=========	=========	=========
TOTAL PROFIT					

Figure 18. Profit Base Output

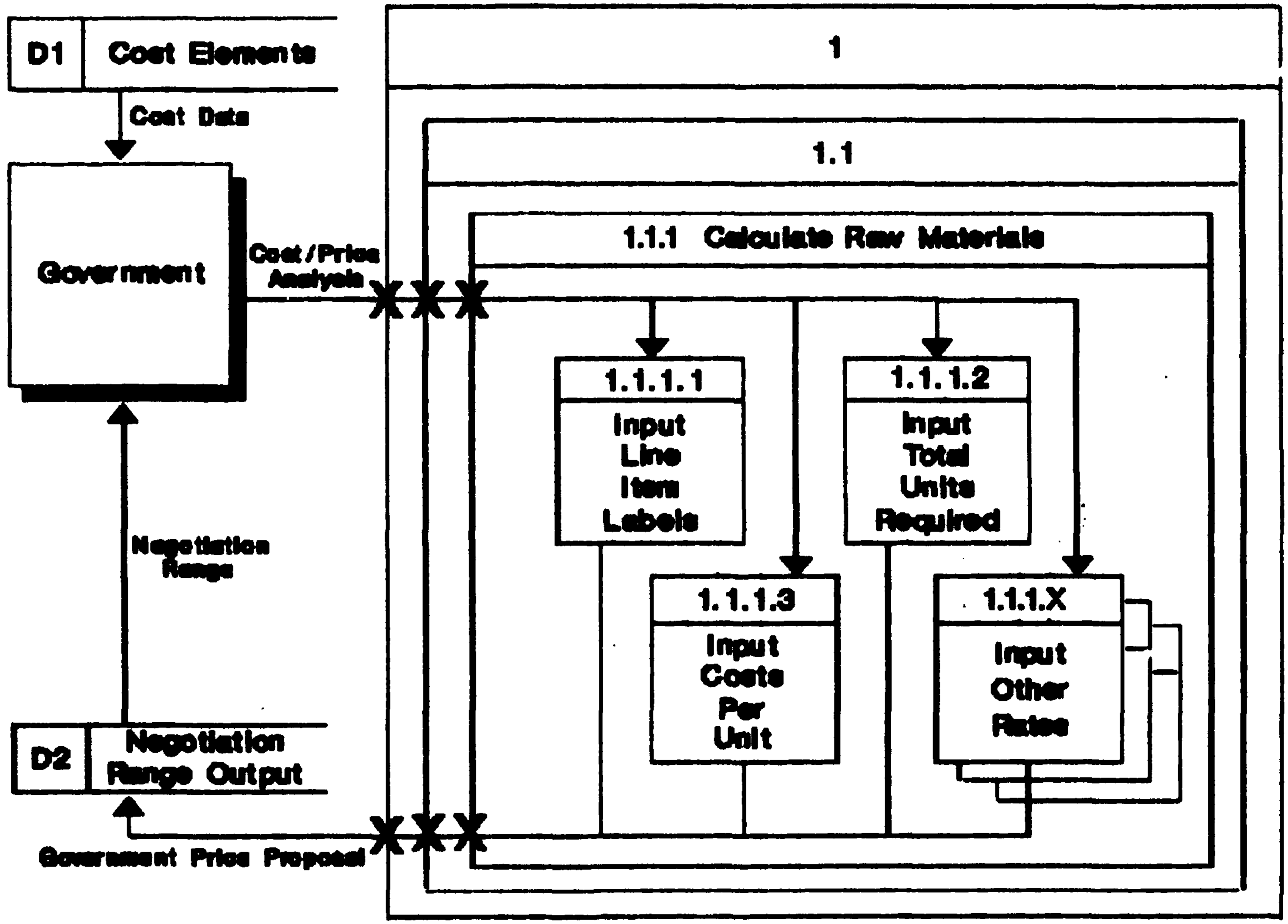

Figure 19. Calculate Raw Materials (Process 1.1.1)

those depicted, include, but are not limited to, scrap rates, handling costs, carrying costs, and learning curves (Figure 19 --Process 1.1.1.X).

Specific line item labels (Figure 19--Process 1.1.1.1) are assigned for each raw material, subcontracted item, standard item, interorganizational transfer, and purchased part. The total number of units required is entered (Figure 19--Process 1.1.1.2). There will be a minimum, objective, maximum, contractor, and negotiated cost per unit input corresponding to each label (Figure 19--Process 1.1.1.3).

Costs per unit are multiplied by the total number of units required, yielding total costs for each line item. These line item total costs will then be added, thereby yielding total raw material, subcontractor item, standard item, interorganizational transfer, and purchased parts costs.

Figure 20 (Raw Materials Output) depicts what output for raw materials at this level may look like. Output for subcontractor items, standard items, interorganizational transfers, and purchased parts would be similar.

For example, the minimum cost per unit of material A would be multiplied by the total units required for material A, thereby producing the minimum total cost for material A. The minimum total costs for materials B, C, and D would be calculated in the same manner. Then, the minimum total costs

RAW MATERIALS	TOTAL UNITS REQUIRED	MINIMUM COST/UNIT	OBJECTIVE COST/UNIT	MAXIMUM COST/UNIT	CONTRACTOR COST/UNIT	NEGOTIATED COST/UNIT
MATERIAL A						
MATERIAL B						
MATERIAL C						
MATERIAL D						

RAW MATERIALS	MINIMUM TOTAL COST	OBJECTIVE TOTAL COST	MAXIMUM TOTAL COST	CONTRACTOR TOTAL COST	NEGOTIATED TOTAL COST
MATERIAL A					
MATERIAL B					
MATERIAL C					
MATERIAL D					
	=========	=========	=========	=========	=========
TOTAL RAW MATERIALS COST					

Figure 20. Raw Materials Output

for materials A, B, C, and D would be added. The sum would be the total minimum raw materials cost.

b. Calculate Factory (Figure 21--Process 1.2.1) and Engineering Labor

Figure 21 (Calculate Factory Labor) depicts the calculation of factory labor. Calculation of engineering labor would be similar, therefore it is not shown. The process (Figure 21--Process 1.2.1) is performed by an unprescribed number of subsystems (Figure 21--Processes 1.2.1.1, 1.2.1.2, 1.2.1.3, & 1.2.1.X). Subsystems, other than those depicted, include, but are not limited to, learning curves, level of effort, historical data, labor standards, and plant condition factors (Figure 21--Process 1.2.1.X).

Specific labor category labels (Figure 21--Process 1.2.1.1) are assigned for each kind of labor. There will be a minimum, objective, maximum, contractor, and negotiated wage per hour, or salary per period, input corresponding to each label (Figure 21--Process 1.2.1.2). Figure 22 (Labor Rates Output) depicts what output at this level may look like.

There will be a minimum, objective, maximum, contractor, and negotiated estimated labor hours, or estimated number of salary periods, input corresponding to each label (Figure 21--Process 1.2.1.3). These labor hour estimates can then be added to yield the total labor hours for the entire contract. Figure 23 (Estimated Labor Hours Output) depicts what output at this level may look like.

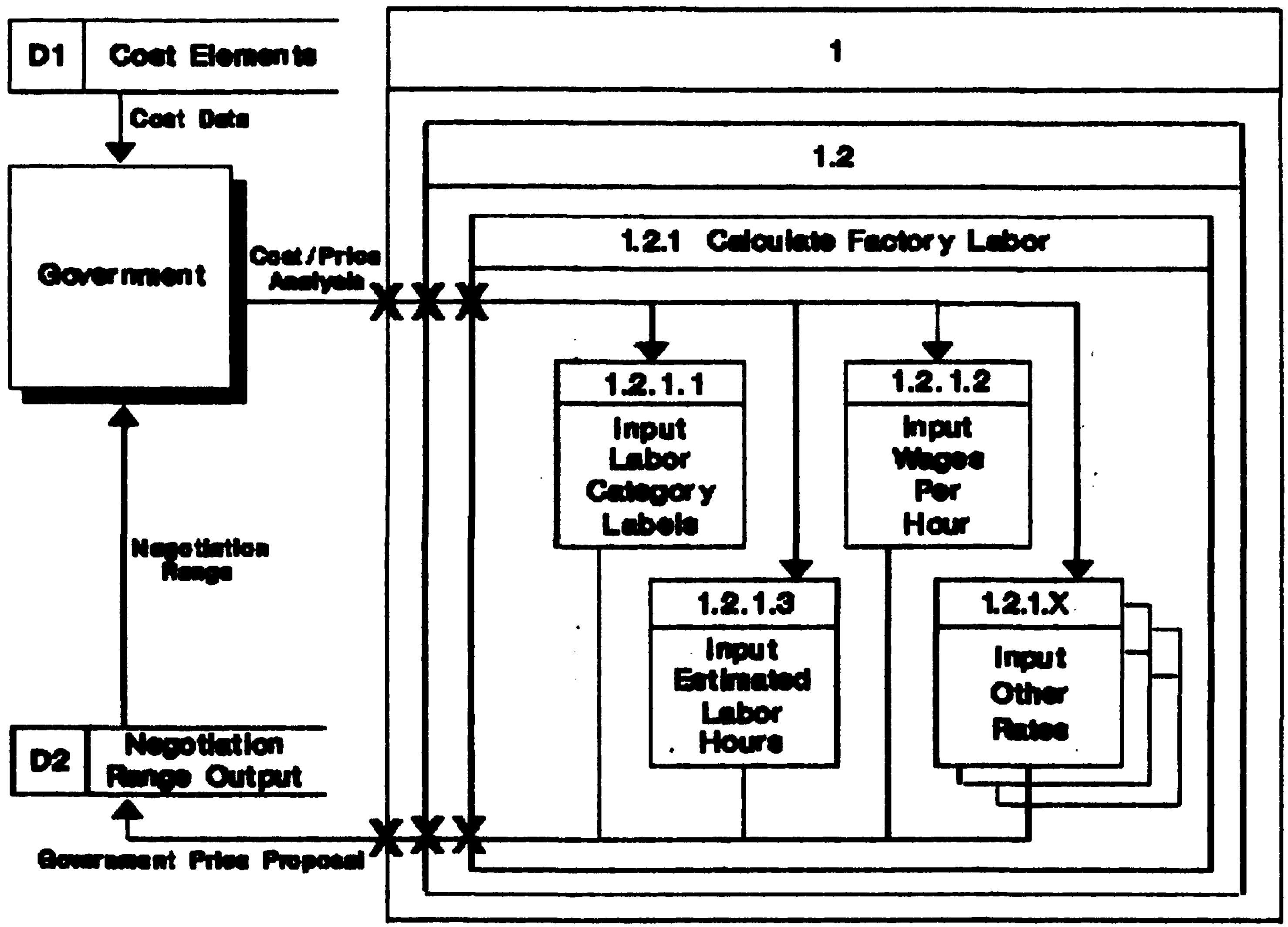

Figure 21. Calculate Factory Labor (Process 1.2.1)

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
FACTORY LABOR RATES					
LABOR CATEGORY					
MACHINE					
ASSEMBLY					
TEST					
ENGINEERING LABOR RATES					
LABOR CATEGORY					
DESIGN					
DRAFTING					
AERONAUTICS					

Figure 22. Labor Rates Output

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
FACTORY LABOR HOURS					
LABOR CATEGORY					
MACHINE					
ASSEMBLY					
TEST					
	----------	----------	----------	----------	----------
TOTAL FACTORY LABOR HOURS					
ENGINEERING LABOR HOURS					
LABOR CATEGORY					
DESIGN					
DRAFTING					
AERONAUTICS					
	----------	----------	----------	----------	----------
TOTAL ENGINEERING LABOR HOURS					
	==========	==========	==========	==========	==========
TOTAL ESTIMATED LABOR HOURS					

Figure 23. Estimated Labor Hours Output

The minimum, objective, maximum, contractor, and negotiated estimated labor hours for each labor category (Figure 23--Estimated Labor Hours) are multiplied by their respective labor rates for each category (Figure 22--Labor Rates), thereby producing labor costs for each labor category (Figure 11--Direct Labor).

c. Calculate Tooling (Figure 24--Process 1.3.1), Operating Expenses, Tires and Tubes, Oil and Grease, Equipment Rental, and Other Direct Costs

Figure 24 (Calculate Tooling) depicts the calculation of tooling costs. Calculation of the other direct expenses within the other direct cost subsystem (Process 1.3) would be similar, therefore they are not shown. This process (Figure 24--Process 1.3.1) is performed by two subsystems (Figure 24--Processes 1.3.1.1 & 1.3.1.2), as depicted.

Specific other direct cost labels are assigned for each kind of other direct cost (Figure 24--Process 1.3.1.1). There will be a minimum, objective, maximum, contractor, and negotiated cost input corresponding to each label (Figure 24--Process 1.3.1.2). These line item costs will then be added, thereby yielding total other direct costs, such as tooling, operating expenses, tires and tubes, oil and grease, and equipment rental.

Figure 25 (Tooling Costs Output) depicts what output for tooling costs at this level may look like.

For example, the minimum costs for jigs, dies, fixtures, and test equipment would be added to yield the total

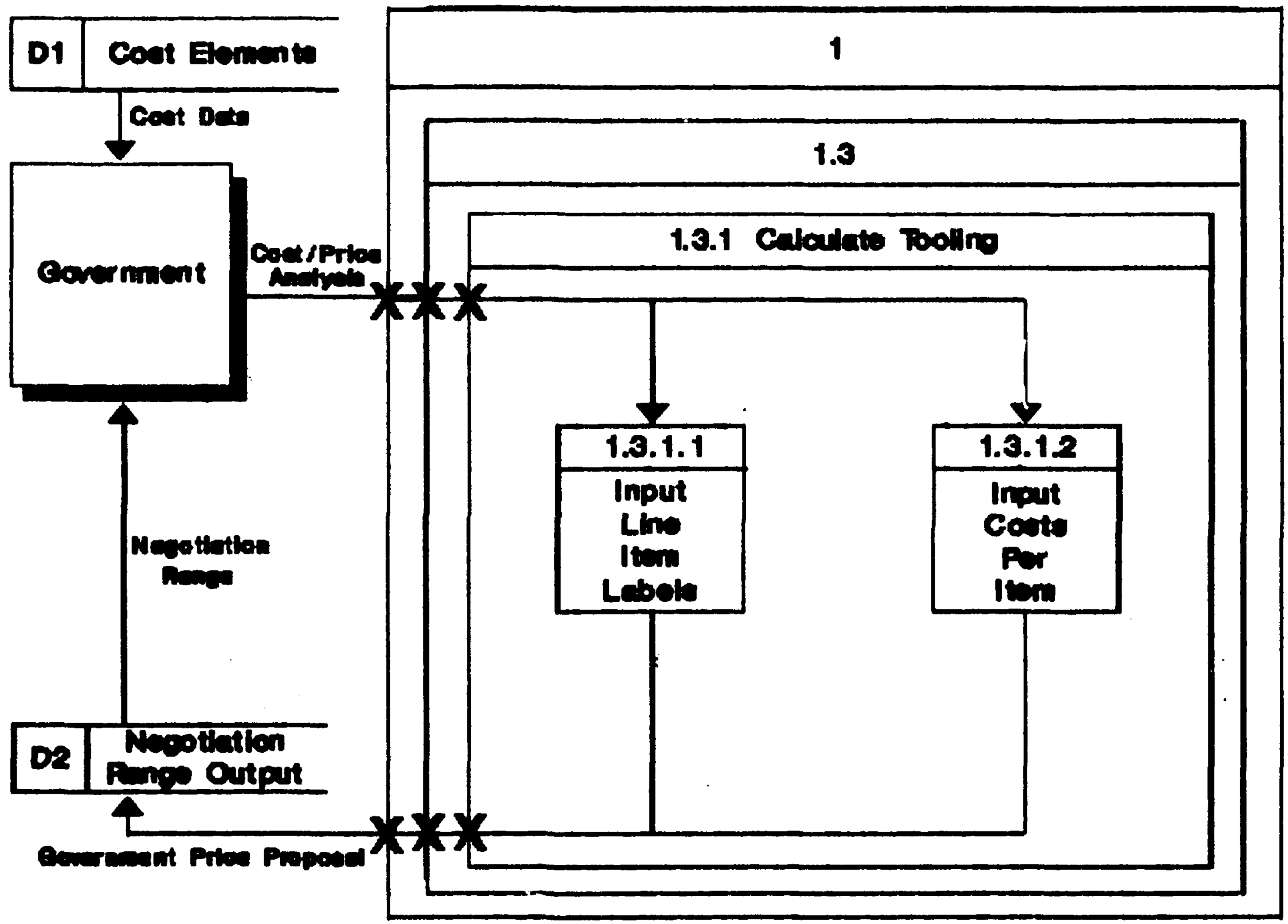

Figure 24. Calculate Tooling (Process 1.3.1)

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
OTHER DIRECT COSTS					
TOOLING					
JIGS					
DIES					
FIXTURES					
TEST EQUIPMENT					
	==========	==========	==========	==========	==========
TOTAL TOOLING COSTS					

Figure 25. Tooling Costs Output

minimum cost for tooling. Likewise, the minimum costs to operate two trucks and two generators would be added to yield the total minimum direct cost for operating expenses, and so on.

d. Calculate Material (Figure 26--Process 1.4.1), Factory and Engineering Overhead, and General and Administrative Expense Bases

Figure 26 (Calculate Material Overhead) depicts the calculation of material overhead. Calculation of factory and engineering overhead, general and administrative expenses, and other indirect costs would be similar, therefore they are not shown. This process (Figure 26--Process 1.4.1) is performed by two subsystems (Figure 26--Processes 1.4.1.1 & 1.4.1.2).

There will be a minimum, objective, maximum, contractor, and negotiated rate input for each type of indirect cost (Figure 26--Process 1.4.1.1).

The material (Figure 26--Process 1.4.1.2), factory, and engineering overhead bases are derived from the totals depicted in Figures 9 (Direct Materials) and 11 (Direct Labor) respectively.

The general and administrative expense base is derived from Figure 4 (Level Zero Output) by adding total direct costs to total overhead costs.

Figure 27 (Material Overhead Output) depicts what output for material overhead costs at this level may look like.

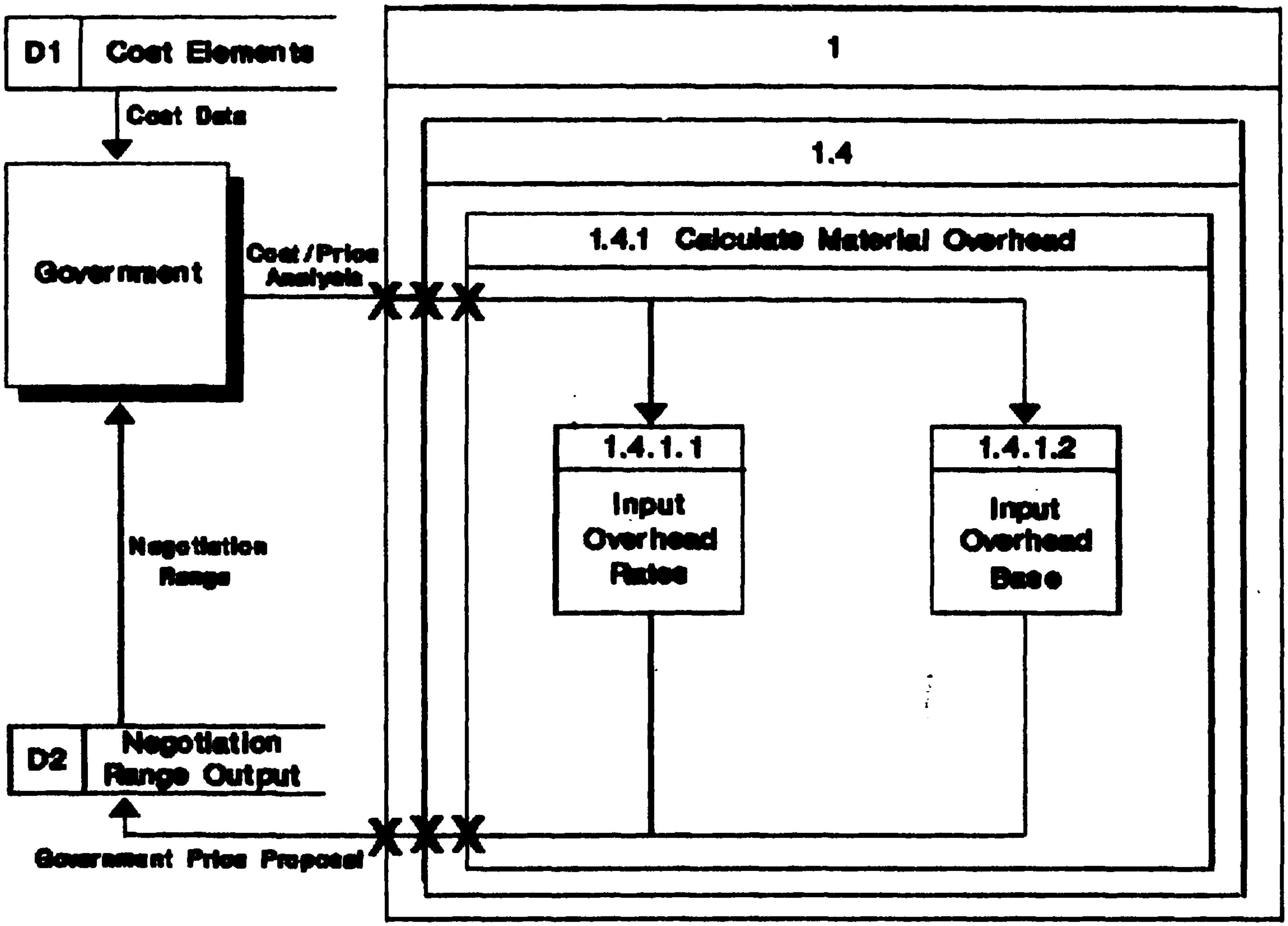

Figure 26. Calculate Material Overhead (Process 1.4.1)

	MINIMUM	OBJECTIVE	MAXIMUM	CONTRACTOR	NEGOTIATED
MATERIAL OVERHEAD					
BASE					
RATE					
	==========	==========	==========	==========	==========
TOTAL MATERIAL OVERHEAD					

Figure 27. Material Overhead Output

The bases for the other indirect cost pools (Processes 1.4.2, 1.4.3, 1.4.4, & 1.4.X) are calculated by adding the applicable expenses. For example, the base for scrap and spoilage may be derived from the sum of only materials A and B (Figure 20--Raw Materials).

e. Calculate Weighted Guidelines Method (Figure 28)

The Weighted Guidelines Method (Figure 28) requires the application of DD Form 1547. The Weighted Guidelines Method is described and calculated in accordance with DFARS 215.970.

A minimum, objective, maximum, contractor, and negotiated value is required for each applicable input in order to produce the five separate outputs as described in Section E.3 of this chapter (Figure 16--Process 1.5.1).

For example, the minimum materials, subcontracts, direct labor, indirect expenses (less general and administrative expenses), other direct costs, and general and administrative expenses are derived from level two output. Next, minimum performance risk, contract type risk, and working capital are determined in accordance with the designated ranges as described in DFARS 215.970. Then, in accordance with DFARS 215.970, the total minimum profit objective is calculated. This process would be repeated for the objective, maximum, contractor, and negotiated positions as well.

RECORD OF WEIGHTED GUIDELINES APPLICATION					REPORT CONTROL SYMBOL DD-P&L(Q)1751	
1. REPORT NO.	2. BASIC PROCUREMENT INSTRUMENT IDENTIFICATION NO a. PURCHASING OFFICE	b. FY	c. TYPE PROC INST CODE	d. PRISN	3. SPIIN	4. DATE OF ACTION a. YEAR / b. MONTH

	ITEM	COST CATEGORY	OBJECTIVE
5. CONTRACTING OFFICE CODE			
6. NAME OF CONTRACTOR	13.	MATERIAL	
	14.	SUBCONTRACTS	
7. DUNS NUMBER / 8. FEDERAL SUPPLY CODE	15.	DIRECT LABOR	
	16.	INDIRECT EXPENSES	
9. DOD CLAIMANT PROGRAM / 10. CONTRACT TYPE CODE	17.	OTHER DIRECT CHARGES	
	18.	SUBTOTAL COSTS *(13 thru 17)*	
11. TYPE EFFORT / 12. USE CODE	19.	GENERAL AND ADMINISTRATIVE	
	20.	TOTAL COSTS *(18 + 19)*	

WEIGHTED GUIDELINES PROFIT FACTORS

ITEM	CONTRACTOR RISK FACTORS	ASSIGNED WEIGHTING	ASSIGNED VALUE	BASE (ITEM 18)	PROFIT OBJECTIVE
21.	TECHNICAL	%			
22.	MANAGEMENT	%			
23.	COST CONTROL	%			
24.	PERFORMANCE RISK (COMPOSITE)				
25.	CONTRACT TYPE RISK				
		COSTS FINANCED	LENGTH FACTOR	INTEREST RATE	
26.	WORKING CAPITAL			%	
	CONTRACTOR FACILITIES CAPITAL EMPLOYED		ASSIGNED VALUE	AMOUNT EMPLOYED	
27.	LAND				
28.	BUILDINGS				
29.	EQUIPMENT				
30.			TOTAL PROFIT OBJECTIVE		

NEGOTIATION SUMMARY

		PROPOSED	OBJECTIVE	NEGOTIATED
31.	TOTAL COSTS			
32.	FACILITIES CAPITAL COST OF MONEY *(DD Form 1861)*			
33.	PROFIT			
34.	TOTAL PRICE *(Line 31 + 32 + 33)*			
35.	MARKUP RATE *(Line 32 + 33 divided by 31)*	%	%	%

CONTRACTING OFFICER APPROVAL

36. TYPED/PRINTED NAME OF CONTRACTING OFFICER *(Last, First, Middle Initial)*	37. SIGNATURE OF CONTRACTING OFFICER	38. TELEPHONE NO.	39. DATE SUBMITTED *(YYMMDD)*

OPTIONAL USE

96.	97.	98.	99.

DD Form 1547, AUG 87 *Previous editions are obsolete.*

Figure 28. Calculate Weighted Guidelines Method

f. Calculate Profit Base (Figure 16--Process 1.5.2)

The profit base is the total cost of the contract and is derived from Figure 4 (Level Zero Output) by adding total direct costs and total indirect costs.

F. SUMMARY

This chapter furnished the reader with a functional description of the proposed framework for a standard, stand-alone, computerized contract pricing model. An overview of the proposed model was presented. Next, it addressed the methodology used to present the proposed model. Then, a visual depiction was provided along with a narrative description of the proposed model using a top-down approach--a Context Diagram followed by Level Zero through Level Three Data Flow Diagrams.

The next chapter examines the results of the data collected from a survey of DLA, Navy, and Marine Corps field contracting activities and analyzes the practicability of developing the proposed model.

IV. ANALYSIS

A. PURPOSE

The purpose of this chapter is to analyze the practicability of developing the standard, stand-alone, computerized contract pricing model, as it was presented in Chapter III. An overview of the survey study, the survey sample, survey responses, the questionnaire, results of the analysis of survey responses, statistical inferences, and a practicability analysis are provided.

B. OVERVIEW OF THE SURVEY STUDY

A survey of DLA, Navy, and Marine Corps field contracting activities was conducted to find out if any of them are currently using a contract pricing model. The questionnaire was also used to gain feedback on software currently used and to see if they would be interested in a standard, stand-alone, computerized contract pricing model.

Survey results were mixed. Many field activities are using some sort of a model. Others are using spreadsheet techniques. All activities are utilizing a variety of software.

Many field activities were quite enthusiastic about the prospect of the proposed model.

On the other hand, some field activities felt that it is not practical, or even feasible, to develop a standard, stand-alone, computerized contract pricing model, since contract types and their corresponding proposals are different, cost elements vary so much from contract to contract, and cost accounting systems are so diverse.

It was perceived that some contracting activities have not pursued developing a standard model because of normal workload requirements and the fact that spreadsheets have been the most adaptable application of suiting their needs.

C. SURVEY SAMPLE

A total of 143 questionnaires were sent to all major DLA, Navy, and Marine Corps field contracting activities. Of the 143 questionnaires, 80 were sent to Defense Contract Administration Services Management Area (DCASMA) and Defense Contract Administration Services Plant Representative Office (DCASPRO) activities, 51 were sent to Navy field contracting activities, and 12 were sent to Marine Corps field contracting activities.

D. SURVEY RESPONSES

The response to the survey was as follows:

- Seventy-four activities replied;
- One activity was a duplicate address;
- Five surveys were "returned to sender."

This means that the net number of activities surveyed was 137[1]. Therefore, there was a total combined response rate of 54[2] percent.

More specifically, of the 80 DCASMA and DCASPRO activities surveyed, 38 replied and five were returned to sender. The net number of DLA activities surveyed, therefore, was 75[3], and the individual response rate for DCASMA and DCASPRO activities was 50.7[4] percent.

Of the 51 Navy field contracting activities surveyed, 28 replied for an individual response rate of 54.9[5] percent.

Finally, of the 12 Marine Corps field contracting activities surveyed, eight replied and one was a duplicate address. The net number of Marine Corps activities surveyed, therefore, was 11, with an individual response rate of 72.7[6] percent.

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[1] 143 - 1 - 5 =137

[2] 74/137 = .5401

[3] 80 - 5 = 75

[4] 38/75 = .5067

[5] 28/51 = .5490

[6] 8/11 = .7272

The DLA share of the total response was 51.4[7] percent. The Navy share of the total response was 37.8[8] percent. And, the Marine Corps share of the total response was 10.8[9] percent.

TABLE 1

RESPONSE RATES

Activity Surveyed	Number Surveyed	Number Responded	Individual Response Rate	Total Response Rate
DLA	75	38	50.7%	51.4%
Navy	51	28	54.9%	37.8%
Marines	11	8	72.7%	10.8%
Net Sample	137	74	N/A	54.0%

E. QUESTIONNAIRE

The field contracting activities surveyed were asked the following questions:

- Does your activity have a computerized pricing model?
- If so, what software runs the model?
- Was the model developed in-house?
- If so, who developed the model?
- If the model was not developed in-house, who developed it?
- Does your activity use the pricing model in developing price proposals and during price negotiations both?

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[7] 38/74 = .5135

[8] 28/74 = .3784

[9] 8/74 = .1081

- If so, is the model currently used by your activity adequate for all you activity's price proposal and price negotiation needs? If not, why not?

- If your activity is not using the pricing model for both price proposals and negotiations, is your activity using the pricing model only to prepare price proposals?

- If so, when your negotiators receive a counter-proposal during negotiations, do your negotiators manually calculate their positions? If not, how do they calculate their position then?

- If your activity is not using the pricing model just for price proposals, are you using your pricing model just for negotiations? If so, how are your price proposals developed?

- Does your activity use the pricing model for any other applications besides proposals and price negotiations? If so, what?

- If your activity does not currently have a computerized pricing model, have they ever used one before? If not, why not?

- If so, which computerized pricing model did they use? Why did they stop using it?

- If your activity does not have a computerized pricing model, does your activity use a computerized spreadsheet?

- If not, how does your activity prepare price proposals and how do your negotiators calculate their positions during negotiations?

- If your activity does use a computerized spreadsheet, what software is your activity using?

- Does your activity use the computerized spreadsheet in developing price proposals and during negotiations both?

- If your activity is not using its computerized spreadsheet for both price proposals and negotiations, is your activity using the spreadsheet only to prepare price proposals?

- If so, when your negotiators receive a counter-proposal during negotiations, do your negotiators manually calculate their positions? If not, how do they calculate their position then?

- If your activity is not using the computerized spreadsheet just for price proposals, are you using your spreadsheet just for negotiations? If so, how are your price proposals developed?

- Does your activity use the spreadsheet for any other applications besides price proposals and price negotiations? If so, what?

- Is the computerized spreadsheet currently used by your activity adequate for all your activity's price proposal and price negotiation needs? If not, why not?

- Would your activity be interested in a standard pricing model? If not, why not?

Additionally, the activities were asked to send a copy of their models and computerized spreadsheets, along with any other documentation and formulations they deemed appropriate.

F. RESULTS

The results of the analysis of survey responses follow. Each question is addressed individually below.

1. Does Your Activity Have a Computerized Pricing Model?

Computerized pricing models are used by 37 activities, or 50[10] percent of those surveyed. Some activities have more than one model. Some activities require different models for different contractors. Sometimes, activities require several models for the same contractor because they use them for different divisions or on separate contracts.

2. If So, What Software Runs the Model?

The 37 activities that have models use a variety of software to run the models. The majority of the models are

[10] 37/74 = .5

run using LOTUS 1-2-3. Specifically, 19 out of 37, or 51.4[11] percent of activities that have models, use LOTUS 1-2-3 version 2.01 or later to run their models. Out of 37 activities that have models, six, or 16.2[12] percent, use Enable to run their models. Out of 37 activities that have models, five, or 13.5[13] percent, use both LOTUS 1-2-3 and Enable to run their models. Out of 37 activities that have models, four, or 10.8[14] percent, use Symphony (a LOTUS product) to run their models. Only three out of 37, or 8.1[15] percent of activities that have models, use some other type of software to run their models.

TABLE 2

SOFTWARE CURRENTLY RUNNING MODELS

Software	Number	Percent
LOTUS 1-2-3	19	51.4
Enable	6	16.2
Both LOTUS & Enable	5	13.5
Symphony	4	10.8
Other Software	3	8.1

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[11] 19/37 = .5135

[12] 6/37 = .1621

[13] 5/37 = .1351

[14] 4/37 = .1081

[15] 3/37 = .0811

3. Was the Model Developed In-house?

Almost all of the models were developed in-house. Specifically, 30 out of 37, or 81.1[16] percent, of the models were developed in-house.

4. If So, Who Developed the Model?

All of the models that were developed in-house were developed by a cost/price analyst or someone from the financial services branch of the activity.

Out of the 30 models that were developed in-house, 17, or 56.7[17] percent, were developed by a single individual, while the other 13, or 43.3[18] percent, were developed as a group effort.

5. If the Model was not Developed In-house, Who Developed It?

There were seven models, or 18.9[19] percent, developed outside of the field contracting activity. Of the seven models developed outside of the field contracting activity, four, or 10.8[20] percent, of the models were developed for the contracting activity by the contractor. Of the seven models developed outside of the field contracting activity, two, or

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[16] 30/37 = .8108

[17] 17/30 = .5667

[18] 13/30 = .4333

[19] 7/37 = .1892

[20] 4/37 = .1081

5.4[21] percent, were developed by the Defense Contract Administration Services Region (DCASR) headquarters. Only one contracting activity, or 2.7[22] percent, had their model developed by an independent software developer.

TABLE 3

MODEL DEVELOPMENT

Developer	Number	Percent
In-house	30	81.1
Total Outside	7	18.9
Contractor	4	10.8
DCASR	2	5.4
Independent	1	2.7

6. <u>Does Your Activity Use the Pricing Model in Developing Price Proposals and During Price Negotiations Both?</u>

Of the 37 field contracting activities that are currently using contract pricing models, 29, or 78.4[23] percent, of the activities are using the models for both price proposals and price negotiations.

7. <u>If So, is the Model Currently Used by Your Activity Adequate for All Your Activity's Price Proposal and Price Negotiation Needs? If Not, Why Not?</u>

Out of the 29 activities that use their contract pricing models for both price proposals and price

[21] 2/37 = .0541

[22] 1/37 = .0270

[23] 29/37 = .7838

negotiations, 18, or 62.1[24] percent, believe that their models are adequate for their needs. The portion of activities that have models and feel they are adequate for their needs is 48.6[25] percent.

However, 11, or 37.9[26] percent, of the 29 activities that use their models for both price proposals and price negotiations, feel that their models are inadequate. Since eight activities do not use their models for both price proposals and price negotiations, it is assumed that these activities deem their models inadequate for both purposes. Therefore, 19[27], or 51.4[28] percent, of the activities with contract pricing models feel that these models are inadequate for their needs.

The following are typical responses as to why 11 out of 29 activities that use their models for both price proposals and price negotiations responded negatively:

> A single model does not exist. Contractor proposals vary and each spreadsheet is unique to one proposal. Certain generic models exist for some divisions, but they must be edited for each application.

> We have different variations depending on the contract type and whether things like escalation, averaging cost of facilities capital, interest rates of varying periods of performance, etc. are involved.

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[24] 18/29 = .6207

[25] 18/37 = .4864

[26] 11/29 = .3793

[27] 11 + 8 = 19

[28] 19/37 = .5135

The models are for specific contractors because of differences in pricing methods. (For example), bases for various burdens are different, labor categories are different, labor rates may be (yard-wide) or specific to a labor category, pricing must be (de-escalated) to different bases, etc.

The pricing model developed is for two of our contractors. Different pricing models have to be developed to correspond with various types of proposals submitted by other contractors.

(The model is) adequate for probably 99 (percent) of our cases. Occasionally, some strange or rarely occurring work task will include an unusual cost element not provided for. (The) model is still easily adaptable.

(Our activity has) inadequate hardware, inadequate software, and inadequate training. And, many contractors (have) various accounting systems.

Each contractor is different. That is(,) any one particular (contractor) does not have the same cost elements included in (his) proposals. However, with modifications(,) cost models can be altered to fit (different) situations.

The model is adequate, but because it is in (LOTUS 1-2-3), (the model) is not on all PC's (because) some (PC's) do not have (LOTUS 1-2-3).

I think everyone should be aware that it is very obvious (and) clearly unrealistic(,) or unfeasible(,) to develop one standard pricing model(,) or format(,) for the universe. There are all kinds of contractors who bid/propose in totally different manners/ways and the (price analyst) has to prepare his report to be consistent with the way the contractor has proposed his price submission. We will come closer to using a model developed for each individual contractor, (rather) than trying to develop one standard pricing model for the world. Every pricing office will set up standard formats/models/approaches for preparing pricing reports whenever possible for efficiency and so that the (price analyst) (does not) re-invent the wheel every day.

The models used apply specifically to two contractors. (The models are) not applicable to price proposals received infrequently from a variety of other contractors.

8. If Your Activity is not Using the Pricing Model for Both Price Proposals and Negotiations, is Your Activity Using the Pricing Model Only to Prepare Price Proposals?

Of the eight field contracting activities not using their pricing models for both price proposals and negotiations, five activities, or 13.5[29] percent, are using them exclusively for price proposals only.

9. If So, When Your Negotiators Receive a Counter-proposal During Negotiations, Do Your Negotiators Manually Calculate Their Positions? If Not, How Do They Calculate Their Position Then?

Of the five field contracting activities that use their models only for price proposals, three activities, or 8.1[30] percent, manually calculate their positions during negotiations.

Of the five field contracting activities that use their models only for price proposals, one activity, or 2.7[31] percent, calculates its position by some other means during negotiations. The following is a statement from that activity:

> Our negotiators (use various methods). (Some) calculate (their) positions manually, (some) have the price analyst recalculate a position using the pricing model, (and others) recalculate (their position) using a separate model which they have developed on their own.

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[29] 5/37 = .1351

[30] 3/37 = .0811

[31] 1/37 = .0270

Of the five field contracting activities using models only for price proposals, one activity, or 2.7[32] percent, does not conduct negotiations, therefore the question does not apply. The following is a statement from that activity:

> Negotiations are not done here. We send a floppy of our model to the negotiator with each proposal.

10. <u>If Your Activity is Not Using the Pricing Model Just for Price Proposals, are You Using Your Pricing Model Just for Negotiations? If So, How are Your Price Proposals Developed?</u>

Of the eight field contracting activities not using their pricing models for both price proposals and negotiations, three activities, or 8.1[33] percent, are using their models for price negotiations only.

All three of the activities that use their models only for price negotiations develop their price proposals using computerized spreadsheets. The portion of activities with models that develop their price proposals using computerized spreadsheets is 8.1[34] percent.

11. <u>Does Your Activity Use the Pricing Model for Any Other Applications Besides Proposals and Price Negotiations? If So, What?</u>

Out of the 37 field contracting activities that have contract pricing models, 34, or 91.9[35] percent, do not use

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[32] 1/37 = .0270

[33] 3/37 = .0811

[34] 3/37 = .0811

[35] 34/37 = .9189

their models for any purpose other than price proposals and price negotiations.

However, three of the 37 activities, or 8.1[36] percent, said that they did have other applications for their models.

The following are statements from the three activities that have applications for their models besides price proposals and price negotiations:

> Our pricing programs incorporate the business clearance.
>
> In addition to price proposals and price negotiations, the model is used for making estimate(s) to (completion).
>
> (In addition to price proposals and price negotiations, the model is used for) field pricing reports.

12. <u>If Your Activity Does not Currently Have a Computerized Pricing Model, Have They Ever Used One Before? If Not, Why Not?</u>

Of the 37 field contracting activities that do not currently have a computerized pricing model, 35, or 94.6[37] percent, have never used one before.

The most typical answer given by these 35 activities was, "(A computerized pricing model was) not available."

The following are other statements that some of the activities made:

> (This activity is) almost exclusively involved with competitive and/or commercial type items.
>
> We do not consider that a pricing model is adaptable to the many pricing scenarios utilized by prospective contractors.

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[36] 3/37 = .0811

[37] 35/37 = .9459

(This activity is) not aware of (a pricing model ever being used), and (we) have not needed (a pricing model) before.

We have not used one, but (we) have reviewed and commented on several (that were) provided by our regional office. None were appropriate or had wide application.

As a small purchase activity, there is no need for such a model, as price breakdowns are not usually required.

Spreadsheets are used exclusively.

(This activity has) low volume. (There have) only (been) three significant negotiations over (a) three year period.

This activity has achieve(d) very high rates of competition and extensive cost analysis or price analysis is normally not required. Price reasonableness is determined based on competition.

(This is) a small base buying activity heavily oriented toward small purchase. (We are) unaware that such models exist.

This activity is cognizant of two separate divisions, with different cost structures within the organization. Also, variation(s) in applicable cost elements for different types of proposals and different weapons systems programs (have) made a standardized model (impractical).

(This activity has) little need and no knowledge of any model. Base contracting is (Invitation for Bid), (providing the) low bid(der) (with the) award. (This activity performs) little negotiation.

The opportunity has not presented itself.

Models do not work (due to the) different logic (involved, because) proposals (are) always different.

(There is) too much judgement and fact sensitivity to justify such an item.

It is very difficult, if not impossible to develop a single/multiple model for all cases.

(A pricing model) is not considered to be a worthwhile tool.

13. <u>If So, Which Computerized Pricing Model did They Use? Why Did They Stop Using it?</u>

Only two out of 37, or 5.4[38] percent, of the field contracting activities that currently do not have a computerized contract pricing model, have ever used one before.

The following are statements given by those two activities:

> (This activity used a) locally developed model written in BASIC. Models are too confining. Every proposal has to be the same. They save time, but stifle creativity.

> (This activity used a) tailor made (model) established by (a) cost monitor and (a) price analyst. (The activity) stopped (using the model) when (the contractor) split (and was) bought by (two different corporations). (There are) two new systems (that have) not (been) finalized/approved yet.

14. <u>If Your Activity Does not Have a Computerized Pricing Model, Does Your Activity Use a Computerized Spreadsheet?</u>

All 37 of the field contracting activities that do not currently have a computerized pricing model, use a computerized spreadsheet.

15. <u>If Not, How Does Your Activity Prepare Price Proposals and How do Your Negotiators Calculate Their Positions During Negotiations?</u>

All 37 of the field contracting activities that do not currently have a computerized pricing model use a computerized spreadsheet, therefore this question does not apply.

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[38] 2/37 = .0541

16. <u>If Your Activity Does Use a Computerized Spreadsheet, What Software is Your Activity Using?</u>

The 37 activities that use computerized spreadsheets use a variety of software. The majority of the activities are using LOTUS 1-2-3. Specifically, 11 out of 37, or 29.7[39] percent, use LOTUS 1-2-3 version 2.01 or better. LOTUS 1-2-3 is followed closely by Enable. Out of 37 activities that use computerized spreadsheets, ten, or 27[40] percent, use Enable. Out of 37 activities that use computerized spreadsheets, seven, or 18.9[41] percent, use both LOTUS 1-2-3 and Enable to run their spreadsheets. Of the Marine Corps activities, four, or 10.8[42] percent, use Wang's 20/20. Out of 37 activities that use computerized spreadsheets, two, or 5.4[43] percent, use Symphony (a LOTUS product). Only three out of 37, or 8.1[44] percent, use some other type of software to run their spreadsheets.

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[39] 11/37 = .2973

[40] 10/37 = .2703

[41] 7/37 = .1892

[42] 4/37 = .1081

[43] 2/37 = .0541

[44] 3/37 = .0811

TABLE 4

SOFTWARE CURRENTLY RUNNING COMPUTERIZED SPREADSHEETS

Software	Number	Percent
LOTUS 1-2-3	11	29.7
Enable	10	27.0
Both LOTUS & Enable	7	18.9
Wang 20/20	4	10.8
Symphony	2	5.4
Other Software	3	8.1

17. Does Your Activity Use the Computerized Spreadsheet in Developing Price Proposals and During Negotiations Both?

Out of 37 activities that use computerized spreadsheets, 26, or 70.3[45] percent, use them for developing price proposals and during negotiations both.

On the other hand, 11 out of 37, or 29.7[46] percent, of the activities do not use computerized spreadsheets for both price proposals and negotiations.

18. If Your Activity is Not Using its Computerized Spreadsheet for Both Price Proposals and Negotiations, is Your Activity Using the Spreadsheet Only to Prepare Price Proposals?

Of the 11 activities not using their computerized spreadsheets for both price proposals and negotiations, six

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[45]26/37 = .7027

[46]11/37 = .2973

activities, or 16.2[47] percent, use their spreadsheets to prepare price proposals only.

19. If So, When Your Negotiators Receive a Counterproposal During Negotiations, do Your Negotiators Manually Calculate Their Positions? If Not, How do They Calculate Their Position Then?

Of the six field activities out of 37 using their spreadsheets for price proposals only, all six, or 16.2[48] percent, calculate their positions manually during negotiations.

20. If Your Activity is Not Using the Computerized Spreadsheet Just for Price Proposals, are You Using Your Spreadsheet Just for Negotiations? If So, How are Your Price Proposals Developed?

None of the 37 activities that are using computerized spreadsheets use them for price negotiations only.

21. Does Your Activity Use the Spreadsheet for Any Other Applications Besides Price Proposals and Price Negotiations? If So, What?

Of the 37 field contracting activities that use computerized spreadsheets, five, or 13.5[49] percent, use them for other applications besides price proposals and price negotiations.

The following are statements given by these five activities:

> (Aside from price proposals or negotiations, this activity uses spreadsheets for) abstracts for bids, computations for DD1057, (and) statistics on procurement data.

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[47] 6/37 = .1622

[48] 6/37 = .1622

[49] 5/37 = .1351

(Aside from price proposals or negotiations, this activity uses spreadsheets for) budget formulation and control, and management data control functions.

(This activity uses) (Automation of Procurement and Accounting Data Entry)(system), (for) automated (Naval Supply) purchasing.

(Aside from price proposals or negotiations, this activity uses spreadsheets for) both number crunching and data-base management.

(Aside from price proposals or negotiations, this activity uses spreadsheets for) departmental budgeting and reports.

22. Is the Computerized Spreadsheet Currently Used by Your Activity Adequate for All Your Activity's Price Proposal and Price Negotiation Needs? If Not, Why Not?

Of the 37 field contracting activities that use computerized spreadsheets, 34, or 91.9[50] percent, find them adequate for their needs. Only three, or 8.1[51] percent, of the activities feel that their spreadsheets are inadequate.

The following are statements from two of the activities that feel their spreadsheets are inadequate:

(This activity) would like to use a pricing model that would be general in scope, so that it would be useable in all pricing situations.

All proposals have to be changed. (There is) no (single) format because of years, rates, etc. No two companys' proposals (are the) same.

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[50] 34/37 = .9189

[51] 3/37 = .0811

23. Would Your Activity be Interested in a Standard Pricing Model? If Not, Why Not?

Of the 74 field contracting activities surveyed, 39, or 52.7[52] percent, said that they would be interested in a standard pricing model. Virtually all of those 39 stipulated a caveat that the model must be flexible enough to accommodate various cost accounting systems and many different contractor proposal formats.

Of the 39 activities that responded "yes" to a standard pricing model, 19, or 48.7[53] percent, are activities that are currently using models and 20, or 51.3[54] percent, are activities that are currently using spreadsheets.

On the other hand, 35 activities, or 47.3[55] percent, said that they were not interested in a standard pricing model.

Of the 35 activities that responded "no" to a standard pricing model, 18, or 51.4[56] percent, are activities that are currently using models and 17, or 48.6[57] percent, are activities that are currently using spreadsheets.

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[52] 39/74 = .5270

[53] 19/39 = .4872

[54] 20/39 = .5128

[55] 35/74 = .4730

[56] 18/35 = .5143

[57] 17/35 = .4857

TABLE 5

INTEREST IN A STANDARD PRICING MODEL

Interested?	Number	Percent
Yes	39	52.7
Yes (Models)	19	48.7
Yes (Spreadsheets)	20	51.3
No	35	47.3
No (Models)	18	51.4
No (Spreadsheets)	17	48.6

The following are statements from those activities that responded "no" to a standard pricing model:

We have already customized our model to adapt to the various accounting systems for each of the contractors we review.

Our pricing model must be compatible with (the contractor's) proposal and accounting system.

Our primary model, the cost summary spreadsheet, is individually tailored to virtually each contractor under our cognizance. This is necessary since pricing proposals are usually structured differently by each offeror. (In other words,) the particular cost elements vary somewhat by contractor.

Generic (models) are too big, too little, etc. Personalization is a must for ease of use.

Each proposal is different. Some proposals are line item by year, some by (work breakdown structure), etc. Each (model) has to be prepared to be consistent with the proposal and the way the particular (contracting officer) wants the recommendations developed. It is not logical to try to have one model for the universe. Each pricing office would never want to get into a situation where they were expected to submit every pricing report in a particular format when different situations or approaches might warrant/dictate another approach.

Each individual model is unique to that contractor.

Our models are (contractor) division and program specific.

Generally, our activity is too diverse. One model is usually too generic to address the varying pricing structures received.

Considering the dozens of contractors handled, each with its own pricing methodology, I question whether a standard model could be used.

(This activity is not interested in a standard pricing model,) unless the model can be adapted to different shipbuilders and methods of pricing.

Our rate structure (is) somewhat different than other activities.

Standard pricing models are designed for a particular contractor(,) not (for) all (contractors). Each contractor is different.

We believe (our model) to be far more comprehensive and utilitarian than any other (model) yet developed.

All contractors have unique accounting systems. Each pricing model is specially tailored for the particular contractor's books, records, and (accounting) system.

(We) (do not) think (a standard pricing model) would accommodate the unique accounting systems of each contractor, or division, without a lot of editing.

(A standard pricing model) probably would not be compatible with (each) contractor's pricing format.

We do not consider that a pricing model is adaptable to the many pricing scenarios utilized by prospective contractors.

We have many contractors submitting proposals. Each (proposal) is unique. A model does not recognize this level of diversity.

(A standard pricing model) cannot be easily used for (the) variety of proposals (we receive). We need to relate to contractors submission, so (our) negotiators are on (the same) level.

(We are) unable to use (a) standard (pricing model) for just the two contractors here, due to differences in (their) estimating systems.

Each proposal stands on its own. Requests for data presentation vary by customer. Models are too confining (because) every proposal has to be the same.

(This) activity is (too) varied. (An) all encompassing model would be cumbersome.

Small purchase is meant to be a streamlined method of procurement without a requirement for detailed price analysis such as a pricing model or computerized spreadsheet would provide.

Each requirement is unique and the variation among the different requirements make(s) the computerized spreadsheet the best tool available.

There is no way to create a generic model which would fit all contractors and all pricing actions, and (still) be useful.

We deal with numerous contractors, all of whom propose in their own unique method. Standardized models are not very relevant to our situation.

With the low volume of proposals and different (accounting) systems used by the various contractors, we develop a computer spreadsheet for each effort.

It seems unlikely that a standard model could accommodate the wide variety of contractor accounting systems that produce cost proposals.

A standard pricing model is not practical due to the (fact that) types and formats of proposals are different, cost elements are different for each contract, and each contractor's cost accounting structure is different. A standard model would be too complex to develop. Maybe a standard model at the corporate, or division, level, but not Navy or Department of Defense wide.

The biggest problems are the differences in accounting systems and proposal formats for each contractor. A standard model is not practical.

Our contractor has two divisions. One division has 23 cost categories, the other has 17 or 18. Each cost has a different name. (A standard pricing model) is just not practical.

(A standard pricing model is) not practical. (There are) different accounting systems, overheads are different, and cost elements are different.

If you want to standardize a (pricing) model, then you must get the contractors to standardize their proposal formats.

One standard model is infeasible due to contractor unique items. Maybe three standard models would be better. A basic, medium, and complex model.

G. STATISTICAL INFERENCES

The purpose of this section is to extract and deduce reasonable inferences from the survey data. This section addresses five inferences that were deduced from the data. They are as follows:

- A collective opinion exists;
- There is a preferred software;
- There is a necessity for computerized automation in developing price proposals and for use during price negotiations;
- The expertise exists to develop computerized contract pricing models in-house;
- There is not a desire or a need for a single agency/ service-wide standard model at this time.

1. Collective Opinion

The sample size of 74, with a combined response rate of 54 percent, represents a little over half of all major DLA, Navy and Marine Corps field contracting activities, even though about half of the sample is represented by DLA activities. The individual response rates of 50.7 percent, 54.9 percent, and 72.7 percent, for DLA, Navy, and Marine Corps respectively, suggest that the inferences do reflect the collective opinions of the activities.

2. Preferred Software

The total percent of activities that use LOTUS 1-2-3 to run their models and spreadsheets is 40.5[58] percent. The total percent of activities that use Enable to run their models and spreadsheets is 21.6[59] percent. The total percent of activities that use both LOTUS 1-2-3 and Enable to run their models and spreadsheets is 16.2[60] percent. The total percent of activities that use Symphony (a LOTUS product) to run their models and spreadsheets is 8.1[61] percent. The total percent of activities that use Wang's 20/20 is 5.4[62] percent. And, the total percent of activities that use other software to run their models and spreadsheets is 8.1[63] percent. The collective percentage that use LOTUS 1-2-3, or a LOTUS compatible product, is 64.9[64] percent. Therefore, it appears that LOTUS 1-2-3 is the preferred software in major field contracting activities.

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[58] (19 + 11)/74 = .4054

[59] (6 + 10)/74 = .2162

[60] (5 + 7)/74 = .1622

[61] (4 + 2)/74 = .0811

[62] 4/74 = .0541

[63] (3 + 3)/74 = .0811

[64] (30 + 12 + 6)/74 = .6486

TABLE 6

PREFERRED SOFTWARE

Software	Number	Percent
LOTUS 1-2-3	30	40.5
Enable	16	21.6
Both LOTUS & Enable	12	16.2
Symphony	6	8.1
Wang 20/20	4	5.4
Other Software	6	8.1
LOTUS Products	48	64.9

3. Necessity of Computerized Automation for Developing Price Proposals and for Use During Price Negotiations

The total percent of activities that use their models or spreadsheets for both price proposals and price negotiations is 74.3[65] percent. The total percent of activities that use their models or spreadsheets for just price proposals is 14.9[66] percent. The total percent of activities that use their models or spreadsheets for just price negotiations is 4.1[67] percent. Only nine, or 12.2[68] percent, of the total activities manually calculate their negotiation positions. And, zero activities manually develop their price proposals. Therefore, it seems that computerized automation is necessary for field

[65] (29 + 26)/74 = .7432

[66] (5 + 6)/74 = .1486

[67] 3/74 = .0405

[68] (3 + 6)/74 = .1216

contracting activities to develop price proposals and to use during price negotiations.

TABLE 7

NECESSITY OF COMPUTERIZED AUTOMATION

Method	Number	Percent
Models/Spreadsheets for Proposals/ Negotiations	55	74.3
Models/Spreadsheets for Proposals Only	11	14.9
Models/Spreadsheets for Negotiations Only	3	4.1
Manually Calculate Negotiation Position	9	12.2
Manually Develop Price Proposal	0	0.0

4. <u>Expertise to Develop a Model In-house</u>

The percent of activities with models that developed them in-house is 81.1. All 30 models developed in-house were developed by cost/price analysts or someone from the financial services branch of the activity. Of the 18.9 percent of the activities that had their models developed outside the activity, 10.8 percent were developed by contractors and 5.4 percent were developed for the activities by the DCASR. This means that the expertise may exist within this 16.2[69] percent, however the expertise was not used. Only one activity with a model used a software developer to produce the model. Of the activities that currently do not use a pricing model, many said that they never used one because one was not available.

[69] 10.8 + 5.4 = 16.2

However, none of the activities that use spreadsheets indicated that they did not use a model because they did not have the expertise to develop one. Therefore, it can reasonably be assumed that the expertise to develop a model exists in-house at almost all field contracting activities.

5. Desire or Need for a Standardized Model

Half of the activities have models and 18, or 48.6 percent, feel that their models are adequate for their needs. The other half of the activities use computerized spreadsheets and 34, or 91.9 percent, feel that their spreadsheets are adequate for their needs. The total percent of activities that feel their models or spreadsheets are adequate is 70.3[70] percent. Of the 29 activities that use their models for both price proposals and price negotiations, 11 feel that their models are inadequate. Since eight activities do not use their models for both price proposals and price negotiations, it is assumed that these activities deem their models inadequate for both purposes. Therefore, 19, or 51.4 percent, of the activities with contract pricing models feel that these models are inadequate for their needs. Only three, or 8.1 percent, of the activities feel that their spreadsheets are inadequate. The total percent of activities that feel their models or spreadsheets are inadequate is 29.7[71]. Only two of the activities that do not currently use models have ever

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[70] (18 + 34)/74 = .7027

[71] (19 + 3)/74 = .2974

tried one before. Additionally, only a little over half of the activities, 52.7 percent, are interested in a standard model. Of this half, the activities are virtually evenly divided between activities with models and those with spreadsheets, 19 and 20 respectively. No group, particularly those with spreadsheets, 51.3 percent, is heavily in favor of a standard model. Furthermore, a great deal of activities doubt the feasibility of developing such a model and even more activities question the practicality of such a model. Therefore, it is perceived that there is not a desire, nor a need, to develop a single agency/service-wide standard model at this time.

TABLE 8

DESIRE OR NEED FOR A STANDARD MODEL

Desire/Need	Number	Percent
Activities with Models	37	50.0
Models Adequate	18	48.6
Models Inadequate	19	51.4
Activities with Spreadsheets	37	50.0
Spreadsheets Adequate	34	91.9
Spreadsheets Inadequate	3	8.1
Total Adequate	52	70.3
Total Inadequate	22	29.7
Interested in a Standard Model	39	52.7

H. PRACTICABILITY ANALYSIS

The focus of this study is the practicability of developing a standard, stand-alone, contract pricing model of an "intelligent" computerized decision support system designed to aid in price calculation. An "intelligent" system is an interactive computer system that does not have problem-solving capabilities, but is intended to guide the user to performing at an expert level.

The proposed model was designed to calculate price positions relative to the Government, the contractor, and the current negotiated position. The main objective was to construct a system that could be used by an unskilled, inexperienced analyst/negotiator to make complex calculations, thereby greatly assisting in the procurement process, as well as potentially saving the Government large amounts of time and money.

> The various cost models have shown a savings from 8:1 to 10:1 in terms of man-hours consumed in pricing computations and report operations, while being very useful in all aspects of the pricing process. [Ref. 7:p. 4]

The analyst/negotiator, using the proposed model, could audit the contractor's price proposal, compute a negotiation objective based on the results of his analysis, recompute a position during negotiations and present cost/price data in formatted hard-copy spreadsheets.

However, several issues arose surrounding the practicability of developing a standard, stand-alone, computerized contract pricing model for the Navy. There are four questions concerning these issues that will be addressed. They are:

- What is the state of existing technology?
- Is developing the proposed model feasible?
- Is developing the proposed model practical?
- What is the current environment?

1. <u>What is the State of Existing Technology?</u>

Advanced technology in the form of personal computers already exists at field contracting activities. The use of some or all of this technology can assist field contracting activities improve their service by minimizing procurement lead times and maximizing productivity.

One problem related to advanced technology rests with an individual organization's ability to fully understand the available information technology, assess its capabilities and potential applicability, acquire the needed software, and implement it within the procurement environment that already exists.

There is an increased use of automated techniques within field contracting activities, but most of these techniques are "closed systems." In other words, each system deals with the procurement process only as it relates to a particular field contracting activity. In addition, many systems in production use today are using conventional automated data processing (ADP) technologies, many with terminals linked to large mainframe computers.

Acquiring automation capability has become extremely complex. Activities are not buying mainframe computers or the associated peripherals. The systems today are multi-component, consisting of personal computers, workstations, and local area networks. In addition, these systems perform a vast array of functions and are driven by a wide variety of software.

In the past, some contracting activities have interacted with a computer system through the use of a terminal linked to a mainframe system. System failure at peak processing periods was a major drawback to the mainframe system.

The advent of personal computers has provided field contracting activities with computing power that is available under their direct control. Software packages such as LOTUS 1-2-3 are valuable assets to the contracting activity.

The major drawback with personal computers is that computer systems expertise is dispersed in varying degrees among field contracting activities. The result is that some activities have more technical knowledge and are able to develop a better system that applies the resident technology to its full potential. Other activities must be content with inferior techniques because knowledge is not widely disseminated.

Every field contracting activity should be aware of the advantages offered by new technology, they ought to consider developing applications that utilize the technology to its full potential, and they should disseminate information throughout the entire contracting community.

2. Is Developing the Proposed Model Feasible?

In the course of the study, the question of feasibility came up several times. With so many different types of proposals submitted in different formats, and with different cost elements and pools under varying cost accounting systems structured differently from organization to organization, or even within organizations, is it feasible to develop a pricing model that can handle all these variables?

The answer is a qualified yes. The Air Force's COPPER IMPACT project is an example of a successful model. However, two very important considerations must be taken into account.

First, to develop the proposed model in a programming language, such as BASIC or FORTRAN, would be like developing a software package with capabilities similar to LOTUS 1-2-3 or Enable.

Second, to develop the proposed model using a particular brand of software would require either too many complex macros to cover each possible situation, or leaving the proposed model in a very basic form not much different from the software package that drives it.

3. <u>Is Developing the Proposed Model Practical?</u>

The major concern expressed by those activities surveyed was flexibility. Contracting by nature must be flexible.

With so many different types of proposals submitted in different formats, and with different cost elements and pools under varying cost accounting systems structured differently from organization to organization, or even within organizations, is it feasible to develop a pricing model that can handle all these variables? The answer was yes, but two important considerations were raised which question the practicality of the proposed model.

First, it would not be practical for the Navy to develop a model that is essentially a spreadsheet software package when many similar, sophisticated software packages are currently available on the market at a low cost and, also, already exist in field contracting activities.

And second, the proposed model would either be too complex and cumbersome or so basic that it might as well have been left in the original form of the software package that drives it.

Forced standardization, system complexity and cumbersome procedures will offset potential productivity. The ideal system should be responsive and user friendly. Thus, ergonomics becomes a factor. The more standardization, commands and procedures associated with the model, the less flexible and user friendly it becomes, hence the less likely it will be received favorably by price analysts/negotiators.

While there are some common aspects to companys' respective price proposals, cost elements, and accounting systems, there are also many variations to contend with that demand flexibility in a pricing model. Each company has its own cost elements with cost accumulation pools that require different calculations. Additionally, there are financial management, cost estimating, and rate structure peculiarities. Also, some companies have multiple divisions and several locations, each with its own accounting system.

One contractor interviewed has three companies that collectively have over 200 labor, overhead, general and administrative, and facilities capital cost of money pools used to accumulate costs. This contractor also has over 200 bid factors (cost estimating relationships) maintained for use on cost proposals.

Rates and factors are so dynamic and they are constantly being updated or revised to accommodate reorganizations, program realignments driven by budget considerations, and Total Quality Management (TQM) personnel realignment initiatives.

Consequently, cost elements and rate agreements remain elusive due to what can be described as normal instability.

For these reasons, some field contracting activities currently have more than one model to deal with these variations. Some activities require different models for different contractors. Sometimes, field contracting activities require different models for the same contractor for use on separate contracts or because the contractor has different companies or divisions.

Furthermore, field contracting activities prefer different price proposal formats. Many activities have formats they designed and are comfortable with, while others model their formats after their contractor's price proposal format.

If price proposal formats were standardized Navy-wide, it would be extremely difficult to get the defense industry to standardize the submission of their price proposals. If the defense industry were forced to standardize the submission of their price proposals, the Department of Defense would have to standardize the other agencys'/Services' price proposal formats as well. This is a very unlikely proposition.

Currently, some field contracting activities are simply giving the contractors floppy disks and having price proposals submitted by the contractors on floppy disks that include a workspace for the Government field contracting activity to enter its objective position and another workspace for use during negotiations.

Therefore, a Navy-wide standard, stand-alone, computerized contract pricing model certainly is not necessary and does not appear practical. A model at the activity or organizational level has merits. But then, a model is not always necessary.

Small purchase activities would have limited application for pricing models due to the nature of small purchasing. Awards are usually made competitively without price breakdowns, extensive analyses, or negotiations.

Each contracting requirement is unique and the variation among the different requirements makes the computerized spreadsheet the best tool available to small purchase activities.

4. <u>What is the Current Environment?</u>

System standardization is being overlooked because field activities can independently buy low-cost, powerful software packages that meet their individual needs.

Concepts such as networking, portability, connectivity, and interoperability are important concerns for standardization. For these reasons, Navy-wide software standardization warrants consideration.

Currently, during times of reduced resources, cost is another concern. Congressional funding cutbacks are threatening a number of programs. Faced with serious budget constraints, the Navy should not invest a substantial sum of money into the development of the proposed model.

Too often, ambitious designs and grandiose ideas evolve into a system that is comprised of too many "bells and whistles." By utilizing existing software, proven technology and techniques, the cost of developing such a model can be greatly reduced or even eliminated, thus preserving valuable resources.

Finally, some contracting activities have not pursued developing a standard model because of normal workload requirements and the fact that spreadsheets have been the most adaptable application of suiting their needs.

I. SUMMARY

This chapter analyzed the practicability of developing the standard, stand-alone, computerized contract pricing model, as it was presented in Chapter III. An overview of the survey study, the survey sample, survey responses, the questionnaire, results of the analysis of survey responses, statistical inferences, and a practicability analysis was provided.

The next chapter answers the research questions and renders conclusions and recommendations.

V. CONCLUSION

A. PURPOSE

The purpose of this chapter is to answer the research questions and render conclusions and recommendations.

B. ANSWERS TO RESEARCH QUESTIONS

This section will answer the research questions that were stated in Chapter I.

1. Primary Question

a. What is the Practicability of Developing a Standard, Stand-alone, Computerized Contract Pricing Model That Will be Used as a Decision Support System for Contract Pricing and Negotiations?

Developing a standard, stand-alone, computerized, contract pricing model that will be used Navy-wide as a decision support system for contract pricing and negotiations does not seem practicable.

The technology exists and it is feasible to develop the proposed model. However, programming constraints, due to cost element and cost accounting system diversity, and flexibility requirements, would render the model too complex and it would probably not be used.

Additionally, since not all activities utilize the same brands of software, writing the proposed model for a particular brand of software would prevent some activities from employing the model.

Furthermore, a model is not always necessary. Small purchase activities would have limited application for pricing models due to the nature of small purchasing.

Therefore, a Navy-wide standard, stand-alone, computerized contract pricing model is not practical. Such a model at the activity or organizational level has its merits.

2. Subsidiary Questions

a. Do DLA, Navy or Marine Corps Field Contracting Offices Currently Have Computerized Contract Pricing Models That They are Using?

Yes. Currently, one-half of the 74 activities that responded to the survey are using computerized contract pricing models. Some activities use more than one model because of contractor or contract differences.

b. Do Defense Contractors Currently Have Computerized Contract Pricing Models Within Their Companies That They are Using?

Yes. Most major defense contractors have computerized contract pricing models that they use for both pricing and during negotiations.

Currently, some field contracting activities are simply giving the contractors floppy disks and having price proposals submitted by the contractors on floppy disks that include a workspace for the Government field contracting activity to enter its objective position and another workspace for use during negotiations.

All of the defense contractors that were contacted use either a computerized pricing model, computerized spreadsheets, or both.

c. What Elements Should Comprise a Standard, Stand-alone, Computerized Contract Pricing Model and What Functions Should it Perform?

The proposed model is comprised of three major systems--calculate the Government's price proposal, calculate the contractor's price position, and calculate the negotiated price position.

Each of these three major systems is comprised of five subsystems--calculate direct materials, calculate direct labor, calculate other direct costs, calculate indirect costs, and calculate profit.

The calculation of direct materials is performed by five subsystems--calculate raw materials, calculate subcontracted items, calculate standard items, calculate interorganizational transfers, and calculate purchased parts.

The calculation of direct labor is performed by two subsystems--calculate factory labor and calculate engineering labor.

Calculation of other direct costs is performed by an unprescribed number of subsystems. Some examples include--tooling, operating expenses, tires and tubes, oil and grease, and equipment rental.

Calculation of indirect costs is performed by an unprescribed number of subsystems also. Indirect cost accumulation pools include, but are not limited to--material overhead, factory overhead, engineering overhead, and general and administrative costs.

Calculation of profit is performed by two subsystems--the weighted guidelines method and the profit base method.

C. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations that were derived from the survey data and the practicability analysis follow:

- That a collective opinion among DLA, Navy, and Marine Corps field contracting activities exists;
- That there is a necessity for computerized automation in developing price proposals and for use during price negotiations;
- That the hardware and software technology exists to develop the proposed model;
- That it is feasible to develop the proposed model;
- That there is not a desire or a need for a single agency/service-wide standard, stand-alone, computerized contract pricing model;
- That it is not practical to develop the proposed model Navy-wide;
- That the Navy should not invest scarce resources in the development of the proposed model;
- That the proposed model at the activity or organizational level has its merits;
- That the expertise exists to develop computerized contract pricing models in-house at DLA, Navy, and Marine Corps field contracting activities;
- That there is a preferred software used by DLA, Navy, and Marine Corps field contracting activities;

- That Navy-wide software standardization warrants consideration.

D. SUMMARY

This chapter answered the research questions and rendered 11 conclusions and recommendations.

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