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POLICY AND PRACTICE TRENDS
IN
WEIGHTED GUIDELINES

MARCH 1981

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6 POLICY AND PRACTICE TRENDS
IN WEIGHTED GUIDELINES

by

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The pronouns "he," "his," and "him," when used in this publication represent both the masculine and feminine genders unless otherwise specifically stated.

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EXECUTIVE SUMMARY

A. BACKGROUND. The Weighted Guidelines (WGL) method is an approach to assure the proper usage of various factors in deriving profit objectives for negotiated contracts. The DAR states that each contractor proposal is to be evaluated with respect to its individual merits and a profit objective is to be determined with consideration given to the various profit items. Yet it has been observed that the entire range of allowed profit is not being used. Previous research suggests that the weights (profit items) which make up Government's profit objective tend to cluster closely around certain values, making costs and prices insensitive to the allowable values and therefore more predictable by the contractor.

B. OBJECTIVES. The objectives of this report are:

1. To determine whether there is clustering of individual profit items around medians of allowable ranges.

2. To identify the relationships of the various factors used in the Weighted Guidelines process which tends to make negotiated outcomes predictable.

3. To identify those profit factors which cause (or explain) variations in percent profit.

4. To make inferences and recommendations on the use of the Weighted Guidelines policy based upon the results of the objectives above.

C. STUDY APPROACH. A literature search and review of previous studies in the profit policy area was made. A model of the policy-making process was developed to illustrate the different parts of the process. Interviews of contracting officers and price analysts were conducted as part of the preparation for this study. Based upon the interviews and data on Army negotiated contracts for fiscal year 1977 through 1979, a set of computer programs was developed. Based upon the interviews, analysis of data, and various observations made, conclusions and recommendations are made.

D. SUMMARY AND CONCLUSIONS. The policy to derive objectively negotiated profit is being carried out when viewed from the averages of the weights alone. However, the intent of the policy is not being adhered to in view of the narrow range of weights being used despite the allowance in the policy for a much broader allowable range. Consequently, negotiated cost, price, and profit become a predictable function of the contractor's proposed cost. Despite the presence of several factors which are to be considered in determining percent profit, the actual percent profit depends upon whether the contract is a cost-type or price-type contract. The analysis also indicates that a target percent profit exists which tends to prevent the intent of the policy from being realized. Finally, there appears to be a threshold of percent profit for cost-type contracts which causes proposals which exceed it to be scrutinized more than others.

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CHAPTER I

INTRODUCTION

A. BACKGROUND.

Recent analyses of Army contracts indicate that a narrow range of percent profit is being negotiated. However, wider ranges of profit are allowed in the Defense Acquisition Regulation (DAR), the basic document which sets forth the policy on profit negotiations for the Department of Defense. The Weighted Guidelines (WGL) method is the technique set forth by the DAR to prescribe certain allowable profit items and the allowable range of profit for these items for negotiated profit. The method is designed to insure objective negotiation in deriving profit objectives.

The same research that detected a narrow range of negotiated profit revealed a strong relationship between contractor proposed cost and the Government objective. Experienced Government contractors can use this observed relationship to predict Government cost and price objectives and thereby influence the outcome of the negotiations. It has been suggested that negotiators tend to cluster the various items which make up the Government's profit objective closely around the average of the allowable spread of values. This makes costs and prices insensitive to the allowable weights and therefore more predictable by the contractor.

Another potential problem associated with the present system of profit determination is the implementation of policy changes. From FY74 to FY79 there has been a very small increase in percent profit negotiated on a sample of negotiated Army contracts. With the current emphasis on higher profits to stimulate industry, one might expect this increase to have been larger. From FY74 through FY79, the ranges of Weighted Guidelines have

remained constant. However, in 1979, a change in the Weighted Guidelines policy has substantially increased the allowable range on the profit item concerning facilities investment. It may be desirable to predict how the change in policy will affect the negotiated profits after 1980. In order to determine the effects of this and similar changes in Weighted Guidelines policy, it will be necessary to look at the individual factors and items which cause variations or changes in price, cost, profit, and percent profit.

B. OBJECTIVES.

The objectives of this report are:

1. To determine whether there is clustering of individual profit items around medians of allowable ranges.
2. To identify the relationships of the various factors used in the Weighted Guidelines process which tends to make negotiated outcomes predictable.
3. To identify those profit factors which cause (or explain) variations in percent profit.
4. To make inferences and recommendations on the use of the Weighted Guidelines policy based upon the results of the objectives above.

C. STUDY APPROACH.

A literature search of the studies contained in the Defense Logistics Studies Information Exchange (DLSIE) was made to determine if related studies have been conducted. The literature survey also considered the various regulations pertaining to procurement functions, especially those relating to Weighted Guidelines. Negotiated data on non-competitive acquisitions for fiscal years 1977 through 1979 were obtained from DD Form 1499, Report of Individual Contract Profit Plan.

Field data includes interviews with highly experienced individuals from the DARCOM Research and Development community. These interviews provided insight into the implementation of the policy on Weighted Guidelines as seen by officers and other individuals involved in determining the Government's pre-negotiation objectives. These individuals confirmed the earlier observations of the use of narrow range of negotiated percent profit and the relationship between contractor proposed cost and the Government objectives. The interviews suggested specific reasons for these relationships which were used in the empirical contract data.

Following these interviews, hypotheses were re-formulated, data was gathered on the DD 1499's, and a set of computer programs were developed by APRO to analyze the data. Based upon the analysis, interviews, and various observations made while analyzing data, conclusions and recommendations were made.

E. ORGANIZATION OF THE REPORT.

Chapter II discusses a brief model of the acquisition policy process from the standpoint of a feedback system consisting of input, feedback, and integration of feedback and input to form the output at three stages: goals and policy formulation, implementation planning, and implementation. This model is the basis for the analysis of the WGL policy.

While Chapter II attempts to describe what the process should be and this chapter suggests some problems which describe how the process appears to be, Chapter III examines the policy and the actual behavior of the process by analyzing output from one of the management information feedback systems, the DD Form 1499. Chapter III will present the findings of the interviews which confirmed the early observations about the use of Weighted Guidelines. Chapter III establishes normative data which describes

how average contracts look with respect to various factors: type of contract; breakdown of overhead, labor, etc.; and the commodity (aviation, electronics, etc.).

Chapter IV examines the probable changes in implementation as a result of changes in policy. It illustrates how predictions of Government positions on cost, price, and profit can be made with a good degree of accuracy depending on contractor proposals and the significant factors identified in Chapter III. Chapter IV concludes with an example which illustrates the consequences of using the present system which is so predictable by the contractor or the Government.

Finally, conclusions and recommendations are presented in Chapter V.

CHAPTER II
THE WEIGHTED GUIDELINES PROCESS

A. INTRODUCTION.

Since their establishment in 1964, Weighted Guidelines have been repeatedly analyzed, criticized, and changed. Over twenty studies on Weighted Guidelines are registered in the Defense Logistics Studies Information Exchange (DLSIE) alone. Additionally, many articles, some of which are referenced here, deal with various aspects of Weighted Guidelines.

In addition to the empirical data which was sampled and analyzed, this report presents a synthesis of past research encountered. Later chapters will present analyses of data in terms of the model described here. These chapters will provide a basis for confirming the relationships between the WGL policy and practice and between the contractor proposal and the Government objective cited in the first chapter.

B. A MODEL OF THE ACQUISITION POLICY PROCESS.

The purpose of this section is to model the acquisition policy process in terms of a feedback control system. As shown in Figure 1, that portion of the acquisition policy process of concern for this study consists of four parts: goals, resultant policy, implementation plan, and implementation. The model indicates that each part is comprised of three attributes: input, feedback and output. The output of one part becomes the input to the next, and feedback is the perception of the behavior of the process by the various parts. Thus, policy, for example, incorporates various goals which are external to the organization, feedback from other parts of the process, and various organizational or internal goals (e.g., directives and higher policy). These inputs are integrated as shown by the circle in the diagram

and the result is a policy which becomes the input to the organizations which formulate the implementation plan.

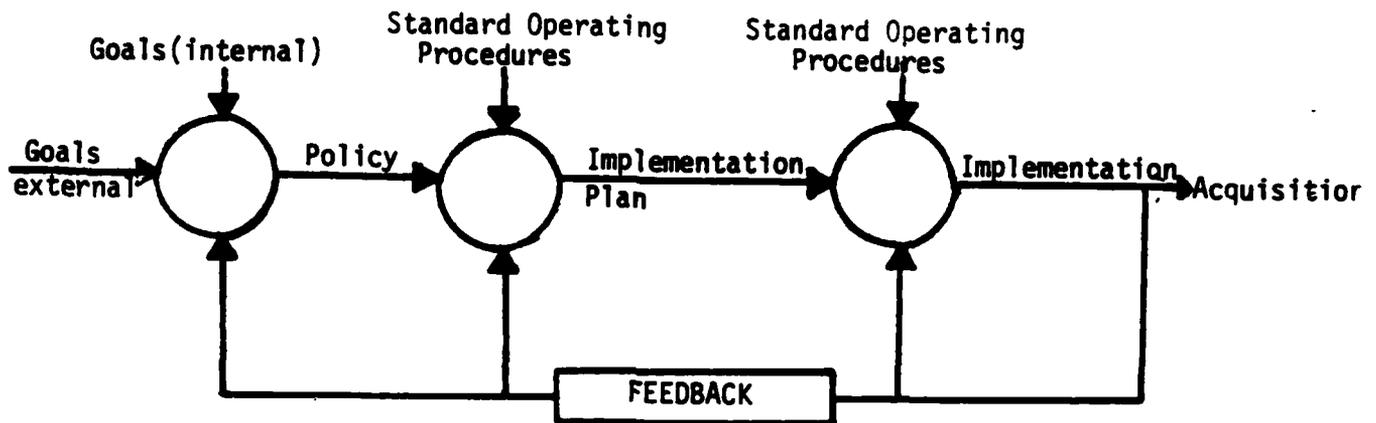


FIGURE 1. ACQUISITION POLICY MODEL

The basic document which articulates the acquisition policy is the Defense Acquisition Regulation (DAR). This document contains the policies and procedures as established by the DAR Council on behalf of the Secretary of Defense. As the model indicates, the policy is an accumulation of many sources. The Armed Services Procurement Act is the primary source of what is labeled external goals in the model. As explained in May 1974 issue of the Commander's Digest (1)* there are also other statutes and sources which are implemented in the DAR. These include:

- Congressional meetings, proposed legislation, and other indications of Congressional interest (Small Business Committees, to name a few).
- GAO reports, opinions, and decisions.
- Decisions by the courts and boards (Armed Services Board of Contract Appeals).

*Numbers in parentheses denote reference number in the list of references.

- Executive orders and other statements of national policy (Buy American and Equal Employment Opportunity, for example).

- Regulations from other agencies impacting on procurement (such as the Labor Department determinations on wage and workmen's compensation, EEO, and EPA regulations).

While the above list is in no way exhaustive of all of the sources of external goals, it does indicate a rather broad spectrum of sources from which policy is formulated. As the model indicates, there are also other sources which are incorporated into policy. The internal goals would include directives from the Secretary of Defense. For example, in the mid 60's, Secretary of Defense McNamara directed a change in the policy of cost reimbursement type contracts to be converted to fixed price type contracts (2). To "put teeth" into his contract conversion program, he requested that the Military Departments and Defense Supply Agency set specific targets for several years. It was Secretary McNamara's belief on the one hand that defense contractors should enjoy higher profits and congressional committee criticism on the other hand which led to the establishment in 1964 of what is now called "Weighted Guidelines." Thus, policy resulted from a DOD reexamination of contractor profit. This reevaluation led to the internal goal which was integrated with the external goals of a congressional committee to become a policy which is the area which the current study will investigate.

In addition to the external and internal goals, the model shows that policy incorporates various feedbacks. For example, the Commanders Digest (1) states that other sources for the policy in the DAR are the deficiencies in regulations noted by contracting officers, contractors, and others. These sources of feedback result from the implementation of policy, from the

organizations responsible for developing the implementation plan, and from internal review as well (e.g., GAO audits of contract files).

It is important to note that what has been called policy is not restricted to the DOD level. Indeed, policy is formulated by the various Military Departments and the Defense Supply Agency, even though the DAR is the primary policy source. The Military Departments supplement the DAR with various internal operating procedures and policy but may not restrict the policies in the DAR. Where required, these supplements take the form of regulations and other policy directives based upon the interpretation of the higher policy directives and specific goals and circumstances.

To assure compliance of the directives and to monitor the process, various feedback mechanisms are incorporated in the policy. One such feedback mechanism is the DD 1499 (Report of Individual Contract Profit Plan). The DD 1499 form has been designed to collect various contractor cost, profit, and price data as well as the Government objectives and actual negotiated costs, profit, and price. The DD 1499 Form has been automated, with data available on magnetic tapes through the DOD Contract Finance Committee, Office of the Under Secretary of Defense (Acquisition Policy), the Pentagon. The data on DD 1499's is the source for the Weighted Guidelines research contained herein. A discussion of the principal components of the form is in the section of this report called "Data Source Description."

As shown in Figure 1, the set of policies form an input into the area called implementation plan. Additional inputs consist of the internal organizations's standard operating policy (SOP) and feedback from the implementers (contracting officers). The implementation plan consists of the organizational structure and internal policies necessary to implement

the policies in the DAR. When policies change, a reorganization may also be required. Part of the implementation plan consists of the various military specifications, military standards, and standard contract clauses which assure conformity to the policy.

The final segment of the model in Figure 1 is the implementation itself. After all of the goals are articulated or made into laws, after all of the policy is formulated and promulgated in the various regulations, after all of the implementation plans are designed, the implementation lies with the contracting officer and supporting cast. Discharging the pricing responsibility depends upon the requirements, procurement situation, organization and the contracting officer's abilities (3). The contracting officer uses evaluations from price analysts, cost analysts, and technical analysts; taking into account the goals, directives, policy, and situation when making a decision. The contracts are subject to reviews and audits and are under surveillance of the headquarters concerned with the overall contract administration. These reviews and audits form the feedback loops to the policy makers, implementation planners, and the individual's organization.

It is important to note that this model is a dynamic model, changing as circumstances (or perception of circumstances) change. For example, in the 60's and early 70's the major policy was concerned with fixed price contracts. Aerospace Industries Association reported the following reasons for this policy (4):

1. Statutory preference for advertising.
2. Preference for fixed price in ASPR's and other DOD documents.
3. Fears by the Government that cost reimbursement would lead to contractor inefficiency. This was based upon fear without foundation,

according to Aerospace Industries Association.

4. The belief that technical uncertainties could be eliminated through paper studies.

5. DOD strength arising out of its monopsonistic position.

6. DOD desire to shift financial risks to the contractor.

Many studies during the 70's concluded that this policy of transferring risk from the Government to the contractor was having a negative effect on the industrial base. The feedback mechanisms were very evident in this self-correcting process. These feedback mechanisms consisted of a large number of studies which emphasized the need for selecting the right type of contract, depending upon the specific circumstances. Aerospace Industries Association (4) recommended that "Policy should emphasize the importance of choosing, from the existing spectrum of contract types, that type or combination of types best suited to the particular procurement. Criteria governing selection of contract type should emphasize judgmental assessment of technical uncertainties and program risks." DOD responded to the problem through various studies, including "Profit '76" which allowed contracting officers to negotiate profit objectives based upon the cost risk the contractor assumes, the extent to which the contractor is providing its own facilities and financing, the productivity of the contractor, and the amount of effort used by the contractor to promote foreign military sales (5).

The above discussion illustrates that the acquisition process model is self-correcting. However, this self-correction mechanism is also time-consuming. Many studies in the 1976 time-frame have shown repeatedly the shrunken industrial base (see Reference 6 for discussion). For example, when the decision to procure more M60 tanks was made, only one contractor

was found with the ability to build the turret castings (5). This contractor was reluctant to take the contract and did so only after certain financial assurances were made. The need to stimulate capital investment has been recognized and the Weighted Guidelines policy on Facility Investment has been changed in Fiscal Year 1980 to allow a higher profit on invested capital. The point to be made is that this feedback system, like most other feedback systems, is a self-correcting system with a built-in time lag. The system begins to correct itself when differences between expected behavior (goals and policy) and actual behavior (implementation) are observed.

This research will look into the process just described. The results of the analysis will be compared to various profit policies (7). Later chapters will develop a predictive model to see how changes in policy may effect changes in implementation. The next section will describe in more detail the contents of the DD Form 1499. For those individuals who are familiar with the form, the next section can be scanned with no loss of information.

C. DATA SOURCE DESCRIPTION.

The empirical data for this study was taken from magnetic tapes containing DD 1499's. As mentioned in the previous section of this report, the Weighted Guidelines have been used since the early 60's. Although data on DD 1499's from FY74 to present is available, because of major changes in the form in FY76, only FY77-FY79 data is used in this report.

The DD 1499 form is prepared on all negotiated contracts over \$500,000. It contains information on the contractor (name, location, etc.), on the procurement activity, and similar information about the contract. The form is submitted when the contract is first negotiated (Initial Award) or upon

subsequent changes in cost or profit. This report analyzes both: initial award and updated DD 1499's.

The form also allows for specifications of the type of contract. This can be any one of the following:

- FFP - Firm Fixed Price
- FPI - Fixed Price with Incentive
- FP(E) - Fixed Price with Escalation
- FPR - Fixed Price Renegotiable
- CPAF - Cost Plus Award Fee
- CPIF - Cost Plus Incentive Fee
- CPFF - Cost Plus Fixed Fee

These contract types are traditionally arranged in the order of contractor cost risk, from firm fixed price (maximum contractor risk) to cost-plus-fixed-fee (minimum contractor risk) (4). Selecting one of these contract types also commits the contractor and Government to DAR specified standard terms and conditions (payment, Government property, data, etc.). Additionally, selection of a contract type will affect the allowable limits on profit on certain factors (as explained later).

In addition to the type of contract, the contract is categorized as Manufacturing, Research and Development (R&D), or Services. There are four factors of the contract which are evaluated and assigned weights (percentages reflecting profit). These factors are:

- A. Contractor Effort
- B. Contractor Risk
- C. Facilities Investment
- D. Special Factors

Within each of the four factors above, several subfactors may be found. The actual weight assigned depends upon the subjective assignment of the individual contractor-proposed data. Weights are assigned, depending upon

the type of contract and the classification according to the following Weighted Guidelines published in the DAR.

TABLE 1. WEIGHT RANGES

	Manufacturing	R&D	Services
A. CONTRACTOR EFFORT			
Material Acquisition			
Subcontract Items	1 to 5%	1 to 5%	1 to 5%
Purchased Parts	1 to 4%	1 to 4%	1 to 4%
Other Material	1 to 4%	1 to 4%	1 to 4%
Engineering			
Direct Labor	9 to 15%	9 to 15%	N/A
Manufacturing			
Direct Labor	5 to 9%	5 to 9%	N/A
Services			
Direct Labor	N/A	N/A	5 to 15%
Overhead	N/A	N/A	4 to 8%
Other			
General Mgt	6 to 8%	6 to 8%	6 to 8%
B. CONTRACTOR RISK	0 to 8%	0 to 7%	0 to 4%
C. FACILITIES INVESTMENT	16 to 20%*	N/A	N/A
D. SPECIAL FACTORS			
Productivity	See DAR	N/A	N/A
Independent Devlpmt	1 to 4%	1 to 4%	N/A
Other	-5 to +5%	-5 to +5%	-5 to +5%

*Prior to FY 80, Factor was 6 - 10%.

The Weighted Guidelines Profit/Fee Objective (DD Form 1547) is used to facilitate the calculation of the profit objective. The DD 1499 form also contains the cost/profit proposed by the contractor (called the measurement base), the pre-negotiation cost/profit objectives, and the negotiated cost/profit.

A computer program was written to facilitate the analysis of the DD 1499 data. It has the capability to select the various contract types (or combination of types), commodity, type of award (initial or modification) or classification (R&D, etc.).

The next chapter will discuss the results of the computer aided analysis of DD 1499 data.

CHAPTER III

ANALYSIS: THE POLICY AND ACTUAL BEHAVIOR

A. INTRODUCTION.

The discussion in Chapter II might lead one to conclude that a wide range of weights are assigned to the individual profit factors of Table 1. The intent of the policy is that each contract should be evaluated with respect to its individual characteristics and weights assigned accordingly. However, Chapter I indicates that the intent of this policy is possibly not being carried out. What the interview results in the next section indicate is a tendency to select factors which tend to cluster around the medians of the allowable range of weights. This chapter will analyze the Weighted Guidelines data to determine if there are any trends in the use of Weighted Guidelines used in Army contracts. The analysis will graphically portray the spread of weights for individual factors and compare the medians to the values of Table 1 in Chapter II. This chapter presents, in general, the Analysis of Variance (ANOVA) model, the computer-aided analysis program, the output of the program, and several references which were used in the ANOVA model and computer program. The chapter will conclude with a summary of the observations. Some of this information will be essential for the predictive model development of Chapter IV.

B. FORMULATION OF INITIAL OBSERVATIONS.

As indicated in Chapter I, interviews with highly experienced individuals from the DARCOM Research and Development community were conducted. The results of the interviews tends to support a belief that the medians of the ranges for the profit factors are used in determining

weights for the various factors. The interviewees also generally felt that it was difficult for them to adjust too far from the medians because of the lack of information on specific contractor proposed values. The contracting officers said that they could not negotiate as effectively as they desired due to a lack of specific data and recommendations on cost and technical data. They generally felt that the guidance on the process itself was not rigidly enforced through some command policy, was sufficiently detailed, yet allowed enough flexibility in negotiation. However, they also stated that they were not using all of the flexibility due to the lack of specific information on the contractor's cost proposal. This resulted in the use of medians of the allowable ranges of the profit factors in many cases.

Additionally, many individuals pointed out that the contractors usually had a more thorough understanding of the overall problem, including the specific cost proposal, technical matters, and the Weighted Guidelines process. Contracting officers, on the other hand, said that their knowledge was restricted to primarily the Weighted Guidelines process. It was thought that this placed the contracting officers at a disadvantage in negotiating costs and profits.

Finally, several individuals felt that too much emphasis is placed on the percent profit and too little emphasis is placed on the bottom line (price).

C. DD 1499 FACTORS.

The data used in this report was taken from magnetic tapes containing contract data for Department of Defense negotiated contracts for the period of Fiscal Year (FY) 1977 through FY 1979. Since the scope of this study was limited to Army contracts, the total number of observations for the

three fiscal years is 999 DD 1499's.

As shown in Table 2, the DD 1499 Form has certain factors which are recorded for each entry. These factors shown in Table 2 and the Fiscal Year, represent the DD 1499 items which will be analyzed in this report. All tables and graphs which were generated by programs which were developed by APRO to analyze the DD 1499 data will display the factor(s) and the item(s) within a factor which are analyzed. Several items within various factors have been grouped into an item called "OTHER". Examples of other types of actions would be updates or changes. Additionally, the commodity factor items have been combined into the classifications shown in Table 2. For example, Armaments consists of the Research and Development and the Readiness Commands in DARCOM which are primarily concerned with armaments. The "OTHER" item in the Commodity factor would include all DD 1499 entires not included in one of the six commodities listed.

D. GRAPHS OF WEIGHTS.

As Table 1 in Chapter II indicates, the weights for the categories (manufacturing, R&D, and services) may vary, depending upon the category of the contract. Additionally, the weights may vary, depending upon the type of contract (FFP, FP(E), etc.). Because of the ability to select various categories and factors, fifteen different graphs can be generated for any combination of the five factors shown in Table 2. These graphs can also be generated for each fiscal year. Because of this ability, a very large number of graphs could be generated if desired. However, this would make the report unnecessarily long and would not result in more new information because much of the data remains the same regardless of the fiscal year or subcategory. Accordingly, only those graphs which are sufficiently different will be shown in Appendix A to this report. The

TABLE 2. DD 1499 FACTORS

DEPARTMENT FACTOR

Army
Navy
Marines
Air Force
Other

COMMODITY FACTOR

Armaments
Communications/Electronics
Tank/Automotive
Missiles
Troop Support
Aviation
Other

TYPE OF ACTION

Initial Award
Other Type

W.G. CATEGORY

Materials
Research & Development
Services/Construction

TYPE OF CONTRACT

FFP
FP(E)
FPI
FPR
CPAF
CPFF
CPIF

graphs for Fiscal Year 1979 will be used because they represent the base period as well as being the most current data available. The Analysis of Variance which will be performed later in this chapter will indicate that for most categories and factors there has been no significant change in the weights over the period of FY 1977 to FY 1979, thus supporting the rationale to present only FY 1979 data.

Looking at the statistics at the bottom of the Figure A1, Material Acquisition Percent Profit, it can be observed that the range of percent profit is about 1-5% (smallest to largest value). This corresponds to the 1 to 5% in Table 1 of Chapter II for Material Acquisition Subcontracted Items. Recall that the interviews discussed in section B above indicated that medians were used as a starting point and adjusted, depending on available information. The solid lines enclosing the values in Figure A1 represents the weight ranges of Table 1. The solid line through the graph is the mid point of the range of values. Thus, it can be observed that about 47% of the 147 records are within 0.5% of the median (each cell is 0.5% wide). Also, almost 75% of the 147 records are within 1% either side of the median. Similar graphs were obtained (but not shown here) for the three categories of Table 1: Manufacturing, R&D, and Services. Each of the graphs displayed the same characteristics. Thus, one could conclude that the category is not a determinant in assigning percent profit to the Material Acquisition subfactor. Further analysis will substantiate this observation (the ANOVA section will address the analysis by factor and DD 1499 category).

The evaluation of percent profit continues with Figure A2, Engineering Direct Labor. Note also that Figure A2 has the ranges of Table 1 for Engineering Direct Labor enclosed in solid lines and the median of the range

through the center of the graph. Again, graphs of Engineering Direct Labor profit were obtained for the Manufacturing, R&D, and Services Category with no apparent differences noted. Accordingly, the graphs of the subcategory were not presented in this report.

Graphs of each of the factors of Table 1 were made and are presented in Figures A3 through A7. For each graph, the profit for the Manufacturing, R&D, and Services was graphed with no apparent differences noted. When the subfactors of the Figures A1 through A7 are combined, the results are shown in Figure A8, Total Contractor Effort (Adjusted). The adjustment is a multiplicative factor of 0.70 applied to the sum of the weights for the contractor effort. The factor is obtained from the DD 1499 form. What Figure A8 indicates is a range of profit of about 2 to 7% with an average of 4.8%. The graphs does not enclose an area of the spread of values like the first graphs did because this subfactor is a derived value.

The next major factor in profit weights is contractor risk. Figure A9 shows the distribution of weights for this factor. The allowable spread for this factor is not determined by the category. Inspection of Figure A9 at first suggests a departure from the pattern which has been observed in the contractor effort. Upon inspection of the risk factor for the three categories, the same type of graph was obtained as shown in Figure A9. Thus, the risk weight does not appear to be related to the category of the contract. It appears that at least two, possibly three different functions have been presented in Figure A9 as evidenced by the distinct "peaks" (.1304 and .1043). The next two figures identify the distinct factors which have been observed in Figure A9, Fixed Price and Cost Reimbursement, respectively.

Figure A10 shows the graph of risk for only price contracts (FFP, FP(E), FPI, and FPR). Reference to the DAR shows that the risk factor is to be evaluated on the basis of the type of contract. Figure 10A shows the ranges of FFP and FPI (Manufacturing only) contained in the DAR. It would appear, from this graph, that much of the variation in risk is due to the type of contract. Table 3 shows the profit averages for risk for FY77 through FY79 in order of decreasing risk (indicated in article in reference 4).

TABLE 3. PERCENT PROFIT FOR RISK

Type of Contract	FY 77		FY 78		FY 79	
	Average	Number	Average	Number	Average	Number
FFP	6.44	52	6.56	36	6.66	49
FP(E)	7.30	2	6.40	5	5.00	1
FPI	4.86	10	4.99	13	4.66	23
FPR	3.70	2				
CPIF	1.85	6	1.73	9	2.09	20
CPFF	.66	16	.68	15	.75	22
CPAF*						
All Cost	.99	22	1.08	24	1.39	42
All Price	6.14	66	6.17	54	6.00	73

*No data available for this contract type.

Although the DAR breaks the profit out by contract type and category, the graphs did not indicate any noticeable differences due to category alone. This is perhaps due to the large differences in type of contract relative to differences due to category. The next section will analyze both factors more completely to determine if any significant differences exists in these (and other) factors. It is also noteworthy to observe the "All Cost" and "All Price" lines in Table 3. Very clearly, risk is a function of whether the contract is either a cost-type or price-type contract. The averages for each of these two items closely corresponds to the two "peaks" in Figure A9.

The graph of the next factor, capital employed, in the Weighted Guidelines is shown in Figure A12. As can be observed, the same "clustering" around the DAR allowable spread of weights is present. Some variation in the graphs as a function of type of contract was observed, but the variation did not appear to be caused by the type of contract. Later analysis will show if the variation is significant.

The next two figures A13 and A14 deal with Productivity and Independent Development. Neither factor had a sufficient number of records to make any observation or perform any statistical test regardless of fiscal year. Figure A15, Other Percent Profit, also had few values (relative to the 50 or more most other factors had). These values were the most dispersed for any factor. Looking at Table 1 of Chapter II, it can be observed that the range of profit should be from -5 to +5%. Figure A15, however, shows a range of .8 to 16.8% with most values from 0 to 4%.

Percent profit, the last factor to be illustrated, is shown in Figures A16 through A18. Figure A17 shows the distribution of only the price contracts, while Figure A18 shows the distribution of only cost contracts for FY79. While comparing the shapes of the last two distributions, attention is called to consider the change of scales in the second column of numbers. Figure A17 has a cell width of 1.00 percent and Figure A18 has a cell width of 0.50 percent. The indication from these graphs is that, as might be expected, the most important factor in determining profit is whether the contract is a price-type or cost-type. This observation (and others discussed above) will be formalized into hypotheses statements and statistically analyzed in a later section.

E. WEIGHTED GUIDELINES SUMMARY DATA.

Whereas the previous section has shown graphically how the distributions for the various factors tend to cluster around the medians of the weight ranges, this section will discuss the normative data - how the data looks in general. To do this, the tables in Appendix B through E have been prepared. The paragraphs which follow will explain how to interpret these appendices.

Several observations can be made on the basis of the tables in Appendix B. First, the material type contracts tend to have the highest profit objective, services next highest, with R&D category the lowest profit objective. One of the major items contributing to this difference is risk. Another item which shows a difference with respect to category is the Contractor Total Effort. Note, however, that the materials contracts have the lowest value for this item and R&D has the highest value for this item. This appears to be a contradiction to the observation on category in general (Materials highest profit and R&D lowest profit). This apparent contradiction will be explained later by looking at the relative contributions of each item to the total when Appendix C is examined. Finally, when the type of contract (price or cost) is considered, the major factor contributing to differences in profit objective is risk. Since little differences could be seen in the other factors, the analyses by these factors were not included.

Appendix C displays the average PROFIT/SUBCOST in percentages for FY77 through FY79 for the various items of the DD 1499 form. These tables show the contribution of the various factors to the total profit objective. For example, in Table C1, the overall average total profit objective of 10.24 (next to the last item on the table) consists of 1.12% for materials, 0.87%

for Engineering Direct Labor, 0.59% for Engineering Overhead, etc. for FY77. The total contractor effort accounts for 3.90% out of the total profit on the average; risk accounts for 5.34%, capital employed accounts for .89%, and other factors for a small amount of the average. The item labeled "TOTAL PROFIT/SUBCOST (SUM OF ABOVE)" has a value of 10.24 for FY77 while the item labeled "TOTAL PROFIT/SUBCOST (ITEM 11.D/11.C)" has a value of 9.89. (Items 11.D and 11.C are the lines on the DD 1499 where the total profit and subcost, respectively, are entered. This table shows the ratio of the two items.) The remaining tables in Appendix C illustrates the PROFIT/SUBCOST for the various factors listed at the top of each table.

The information in Appendix C forms the basis for predicting performance based upon policy changes. For example, Table 1 of Chapter II indicates that a change in FACILITIES INVESTMENTS will increase the rate from the FY 1980 rate of 6-10% to 16-20%. Looking at the first table in Appendix C, one would expect an Army-wide change of something less than 1% in the average profit objective as a result in this policy change. Although there appears to be variations in the entries for Capital Employed for the three fiscal years and various factors, the most likely change appears to be around .6 to .9% on the average for Facilities Investment (also called Capital Employed).

Appendix D gives the measurement base (in \$000,000) for the three fiscal years. The actual items which have been itemized represent the cost objectives for the given item. Thus, for fiscal year 1977, the average cost objective for 59 contracts (57 of which were not zero values) for item 12.A(1) Materials was 17.73 (\$000,000). The average contractor total effort cost objective was 41.57 (\$000,000). The patent observation from these tables is that cost objectives have, on the average, been

increasing. The same trend of increasing cost can be seen in the category of contract, with material and R&D category having the highest cost and services the lowest cost objective (on the average). The increasing costs can also be seen when viewed from the type of contract point of view.

The final set of normative data is shown in Appendix E. The tables show the ratio of the measurement base to the subcost for each item on the DD 1499 form. Thus materials (Table E1) is 36.6% (on the average) of the subcost. The subcost total is 100% of the Contractor Total Effort. Risk is 89.83% of the subcost, Capital Employed is 13.54%, etc. (FY77).

To summarize the observations noted thus far, the percent profit appears to be the same for Army initial or Army other actions (updates). However, differences in percent profits are observed, depending on the category of the contract. Differences in other factors (Risk, Capital, etc.) can also be attributed to the category of the contract. Finally, the factor having the most effect on percent profit (and Risk) appears to be the type of contract (cost or price).

In addition to the factors which caused variations in the various graphs, it should be noted that about one half of all of the forms were not completely "itemized." For example, Table C1 shows 93 entries were evaluated for the Total Profit Objective (last line), but only 59 entries were evaluated for the line labeled 12.A(7) CONTRACTOR TOTAL EFFORT. The difference between the two values is the number of DD 1499's which did not "itemize" the individual profit factors (12.A(1) through 12.A(5)). The completeness of itemizing will also be considered a factor and will be analyzed in the section on Analysis of Variance to determine if it can explain some variations in the DD 1499 values.

It should be noted here that the purpose of this section is to lay the groundwork for the analysis which follows. This chapter has demonstrated those factors which are given in the DAR for determining percent profit. If the analysis which follows is to have any credibility, it too must have the ability to determine whether these factors contribute to the variations in percent profit. The analysis which follows will look at percent profit to illustrate that analysis can, in fact, locate those factors which are significant sources (or causes) of variation in percent profit. This will result in additional insights into the Weighted Guidelines use as well as verify the model's ability to accurately locate the sources of variation. The analysis will then be applied to the contractor proposed, Government Objective, and negotiated costs, profits, and price. First, however, some background information on the model is necessary.

F. THE ANOVA MODEL EXPLAINED.

The previous sections of this chapter have shown some of the relationships among the various factors and elements in the Weighted Guidelines process. Although the information which was observed adds some insight into the process, it does not address the significance of the relationships in a statistical sense. The material which follows uses the same data as the previous discussion. A computer program has been developed to perform an Analysis of Variance (ANOVA) of selected factors and values. The list of references contains several texts (8, 9) which deal with ANOVA, and references on computer programs to aid in the automation of the analysis (10,11). The material which follows will provide a brief explanation of the ANOVA model, a discussion of the interpretation of the computer analysis, and a summary of the observations and analysis of this chapter.

The ANOVA model used in this report is commonly called a three factor or three way Analysis of Variance. A factor is something which causes, or is a source of, variation in measurements. For example, the previous discussion suggests that a cause of the variation in profit could be the category of the contract, the fiscal year, commodity, etc. What the ANOVA model attempts to do is partition the total variation (or variance) into assignable causes (or sources) of variation. If there remains a variation which cannot be assigned to a specific source, this remainder of the variation (often called the unexplained variation) is the experimental error. The factors (or sources) are commonly called independent variables and the measurement of the behavior of the performance is commonly called the dependent variable (also called the response variable or criterion variable).

To illustrate the concept of explained and unexplained variation, consider the fiscal year factor. If each fiscal year had exactly the same value, there would be no variation in the criterion variable (percent profit, for example). Consider, however, the case where there is an increasing trend due to the fiscal year (inflation for example, is a trend which causes costs to increase from one year to another). If there were a perfect linearly increasing trend, there would be a variation or change in the criterion variable due to the fiscal year and no random variation (unexplained variation). If, however, instead of all points falling on a line, there is a general pattern of increase in the criterion variable, but not all of the points fall on a single straight line, the results would be both explained variation (the trend) and unexplained variation (the random points which are not on the line). The random variations

are referred to as the unexplained variation since there is nothing to tell why the points did not fall on the straight line. Similarly, the variation due to the trend is referred to as the explained variation since there is a source which explains this variation (the fiscal years).

Ideally, sample sizes (replications) should be the same for each combination of the levels (or items) in a factor. For the fiscal year factor, there are three levels or three fiscal years (1977, 1978, and 1979). For the type of contract, there are 7 possible levels (FFP, FP(E), etc.). The number of replications in the 1977-FFP cell ideally should be the same as the 1977-FP(E) cell, the 1978-CPFF cell, the 1979-CPIF cell, etc. (total of 3 times 7 or 21 cells). However, in general, not all cells will have the same number of replications. For example, there are more FFP contracts than FPI contracts. When unequal sample sizes occur, a method of ANOVA called "Unweighted Means" is used (see Chapter 17 of reference 8).

An experiment is usually designed in such a manner to assure that all of the factors are present for every combination of the levels of each factor. This results in what is called a completely crossed factorial design. However, it is frequently the case that when data is analyzed after the fact (with no specific design for data collection), missing observations (cells with no data) will result. To overcome this, the analyst can either eliminate the entire level of the factor where the missing data exists or estimate the missing value and adjust the degrees of freedom accordingly. The second method was selected for this report. It was determined that the missing data did not occur in any specific pattern and that although one cell may have no observations, nearby adjacent cells may have several replications. Thus, by eliminating empty cells, many other observations would also be eliminated.

6. THE STATISTICAL ANALYSIS OF WEIGHTED GUIDELINES.

Using the computer programs developed for this study, the Analysis of Variance of the DD 1499 data was performed. For ease of interpretation, Table 4 summarizes the results of the significant analyses. The table lists the DD 1499 profit items and the factors analyzed by the ANOVA program. The numbers in the body of the table denote the "strength" of significance: the value of one being the most significant and the value seven being the least significant. Those items and factors with no number are never significant.

In Table 4, consider the risk item first. As discussed in Chapter II, risk is a function of the type of contract and the category of the contract. These factors are significant for any reasonable level of significance for the risk item. The next area of concern is the Percent Profit Objective. It has two significant factors (sources of variation): type of contract and degree itemized (completely or incompletely). Notice, however, that the category of the contract is not very significant for the Percent Profit Objective even though it was significant for the risk and total contractor effort. Also, other items have significant factors for various levels of significance which are not significant for the Percent Profit Objective. The final unanticipated result in Table 4 is the presence of the very significant factor: degree itemized. The ANOVA shows that the DD 1499's which are completely itemized (have all items of the form completed) have significantly higher percent profit objectives than those which are not completely itemized (those which complete only the price, cost, and profit portions).

TABLE 4. SUMMARY OF SIGNIFICANT FACTORS

<u>DD 1499 Profit Item</u>	<u>Fiscal Year</u>	<u>Type of Contract</u>	<u>Category of Contract</u>	<u>Type of Action</u>	<u>Commo- dity</u>	<u>Degree Itemized</u>
Materials		4				X
Engr. Dir. Labor						X
Engr. Overhead						X
Mfg. Dir. Labor						X
Mfg. Overhead	5					X
Other						X
G&A		4				X
Total Cont. Effort	7	6	1	5		X
Risk	7	1	1			X
Cap. Employed			7			X
Productivity						X
Independent Dev.						X
% Profit Obj.		1	7	7	5	1

NOTES:

X - denotes not analyzed (these are "itemized" values)

1 - means always significant

7 - means marginally significant (borders on being not significant)

When the significant factors for the percent profit objective are arranged according to the rank of significance, the results are shown in Table 5.

The implications of the analysis of the percent profit objective thus far are as follows: The type of contract is the single largest contributing source of variation. In general, type of contract would be known before estimates or predictions of the percent profit objective is determined. Since type of contract is a significant factor, it would explain (or predict) a large portion of the variation in profit objective. However, degree itemized is also almost as significant as type of contract. Thus, knowing something about degree of itemizing of the DD 1499 form would also enable one to predict the profit objective. To help in explaining the reason for complete or incomplete itemizing, the ANOVA results for Degree

TABLE 5. RANKING OF SIGNIFICANCE

<u>Rank*</u>	<u>Factor</u>
0	Fiscal Year
1	Type of Action
2	Category
3	Command
4	Degree Itemized
5	Type of Contract

*Larger rank means more significant. Rank equal to zero means not significant for any reasonable level of significance.

Itemized and Type of Contract suggests that certain types of contracts are itemized or not itemized in a predictable manner. To test this hypothesis, ANOVA's were run for Price Contracts and other ANOVA's run for Cost Contracts. For the Price contracts, degree itemized is not a factor. However, for the cost type contracts, degree itemized is a very significant factor. The ANOVA program was also used on the contractor proposed profit and the negotiated percent profit to determine if any pattern could be observed. The results of these analyses are summarized in Table 6.

TABLE 6. ANOVA OF ITEMIZED COST CONTRACTS

<u>Criterion Variable*</u>	<u>Completely Itemized Mean</u>	<u>Incompletely Itemized Mean</u>
Contractor Proposed Percent	9.35	8.27
Government Objective Percent	6.84	7.16
Negotiated Percent	7.84	7.47

*Factors: Degree Itemized, Cost types (CPAF, CPFF, CPIF), and Category
Selected Factors: Army, Initial Actions

An interpretation of Table 6 might be as follows: The proposals which exceed a certain percent profit threshold are more closely scrutinized by the Government by completely itemizing the profit objective. In this case, the Government's objective is significantly lower than what it would have been had it not been itemized. This reactionary process is intended to give the Government more room to negotiate by forcing the differences between the two positions to be very large. Yet, the negotiated profit is still significantly higher than the profit for the incompletely itemized proposal. However, the Government has achieved a substantial reduction in the negotiated profit relative to the initial proposed value.

An analysis of price-type contracts is summarized in Table 7. While Table 6 had all three percent profits significantly different, none of the percent profits of Table 7 are significantly different. It is apparent in comparing Tables 6 and 7 that cost-type and price-type contract negotiation is different. The difference is due to the substantial amount of data available for cost-type contract negotiations as opposed to the small amount of data available for price-type contract negotiations. In those situations where sufficient data is available, when excessive profit is proposed (e.g., exceeding a certain threshold), the proposal can be more closely scrutinized, resulting in significant differences between negotiated profit and contractor proposed values. On the other hand, when lack of data is the case (as in the price-type contracts), no significant difference is noted in the negotiated outcome. This substantiates the interview observations about data availability in Section B to this chapter.

TABLE 7. ANOVA OF ITEMIZED PRICE CONTRACTS

<u>Criterion Variable*</u>	<u>Completely Itemized Mean</u>	<u>Incompletely Itemized Mean</u>
Contractor Proposed Percent	13.48	13.75
Government Objective Percent	11.01	11.14
Negotiated Percent	11.72	11.86

*Factors: Degree Itemized, Price-types (FFP, FPI, FPR, FPE), and Category.

Selected Factors: Army, Initial Actions.

H. COST, PRICE, AND PROFIT ANALYSIS.

Following the pattern of the analysis of Section D of this chapter, the Weighted Guidelines program was used on the contractor proposed, Government objective, and negotiated percent profit, total costs, total profit, and total price DD 1499 data. The averages for these items are summarized in Tables 1 through 4, respectively, in Appendix F. The data consists of the FY79 DD 1499's for the Army. It is given by contract type, all cost type contracts, all price type contracts, and all contracts. The data is given for contractor proposed, Government objective, and negotiated values. As observed in previous analyses, the data in these four tables also indicates some variations by contract type. The objective of the analysis, then, is to determine the significant factors (or sources) of variation. To accomplish this, ANOVA's were performed in a manner similar to the previous section. The results of those ANOVA's are summarized in Table 8.

TABLE 8. SUMMARY OF COST, PROFIT, PRICE ANALYSIS

<u>Item</u>	<u>Fiscal Year</u>	<u>Type of Contract</u>	<u>Category of Contract</u>	<u>Type of Action</u>	<u>Commodity</u>
Contractor					
Cost					
Profit					
Price					
% Profit	7	1	6		
Government					
Cost					
Profit					
Price					
% Profit		1	7	7	5
Negotiated					
Cost					
Profit					
Price					
% Profit	7	1	4		7

NOTES:

1 - means always significant

7 - means marginally significant (borders on being not significant)

As shown in Table 8, the major consideration for percent profit for the contractor, Government, and negotiated values is the type of contract. The percent profit has several other almost insignificant factors. However, for all costs, profits, and prices, none of the factors explain any appreciable amount of variation in values. The Degree Itemized factor was not presented in Table 8 because, as in the previous section, it is significant for the three percent profits.

H. SUMMARY OF CHAPTER III ANALYSIS.

The graphs, figures, tables, and analysis of this chapter have shown that, although the Weighted Guidelines process appears to be working in accordance with the DAR when judged solely by averages, the intent of the DAR is not being followed. The analysis has identified some inconsistencies and an unanticipated result. The major findings of the chapter follow:

- Using averages only, the policy of the DAR is being followed.
- The intent of the policy is not being followed as evidenced by the closely clustered profit factors.
 - The major significant factor in percent profit is type of contract.
 - Various items making up total Percent Profit objective are significant, but only type of contract is significant for the "bottom line."
 - For cost contracts, there appears to be a threshold of percent profit which causes contractors who exceed this value to be scrutinized more (DD 1499 form completely itemized).
 - Cost, profit, and price are not related to any DD 1499 factor (contract type, type of action, etc.), commodity, or degree itemized.

What this chapter has shown is that the predictions cannot be improved upon by including any of the factors since they do not explain any significant variations for cost, price, or profit values. The next chapter will show that the contractor's cost proposal is the single factor which can be used to predict the Government objective and negotiated values.

CHAPTER IV

PREDICTABILITY: THE RESULTS OF THE PROCESS

A. INTRODUCTION.

The previous chapter identified those factors which explain or cause variation in cost, price, profit, and percent profit. ANOVA was used to eliminate any unnecessary analyses of the relationships among the various costs, prices, and profits. The analysis shows that none of the DAR WGL factors are significant sources of variation; thus, inclusion of them in any prediction model would not improve predictability. The problem remains then to determine whether significant relationships exist which enable one to predict with accuracy the Government's objectives and the negotiated values. This chapter will identify those relationships and depict graphically the prediction ability.

B. COST, PRICE, AND PROFIT PREDICTION MODELS.

As part of APRO 80-08, Profit Negotiations (12), an analysis of selected factors was conducted to determine if there were any relationships between contractor proposed values, Government objectives, and negotiated values. That study identified a strong relationship among these three sets of variables. However, because that report was limited to only initial Army entries for price-type material contracts, the analysis is not adequate for this report. However, the report shows that contractor proposed values, Government objective and negotiated costs, profits, and prices are highly related variables.

For the next several pages, a basic discussion of correlation and regression analysis is presented to provide those not readily familiar with the techniques an understanding of the prediction models to follow. Individuals familiar with these statistical methods can skip this material and go straight to the discussion which follows equation 3.

When two variables are highly related, they are said to be dependent or correlated. It was pointed out in the previous chapter that certain relationships exist between cost contract percent profit and degree itemized, for example. An alternative method for determining the "strength" of the relationship is through a correlation analysis. This technique, like ANOVA, determines variances which are explained, unexplained and the total variances. A statistic, called the coefficient of determination, r^2 , is found by taking the ratio of explained to total variation.

A variation exists when a difference between a predicted value and actual value exists. In this case, the variation is unexplained since the prediction model does not tell the correct (or observed) value exactly. However, the measure of the variation from the average to the predicted value is the explained variation since the prediction model causes values to move from the mean. The model used for the prediction equation is called a regression analysis, and the analysis of the variations in the regression model is called correlation analysis (the square root of r^2 is called the correlation coefficient and has the symbol r). The r^2 statistic has as its minimum value zero and its maximum value is one. As defined above, one can see that the only way for r^2 to be zero is when the explained variation is zero. Thus, the model cannot predict any variation. Alternatively, when r^2 is one, the explained variation and total variation are equal (thus, the unexplained variation is zero). For r^2 values then, the model gets closer to a perfect predictor as r^2 gets close to one.

In the regression model, there is one dependent variable and one or more independent variables. It is important to make a distinction at this

point as to the choice of independent vs. dependent variable. Consider cost, for example. The Government's objective and negotiated costs are influenced by the contractor's proposal. Thus, the contractor's cost proposal can be used as the independent variable and the Government objective and negotiated cost, price, and profit can be dependent variables. Because of the process used in determining the Government's objective and the negotiated values, it should be expected that these variables should be highly correlated. Additionally, it may be desired to also develop a model which will enable one to predict one dependent variable with a knowledge of another. The procedures which follow will develop such a model.

For the analysis herein, a logarithmic transformation of the dependent and independent variables was made because the linear model results in some undesirable features due to the nature of the data. For example, much of the data is found to be grouped around values in the million dollar range. However, there is also a considerable amount of data consisting of hundreds of millions of dollars. These high values tend to have a disproportionate influence in the linear regression model. This causes some predictions to have consistently unrealistic results for the smaller values of the independent variables. The predicting model is shown in the following equation:

$$Y = AX^B \quad (1)$$

where Y = dependent variable

X = independent variable

A = value determined by regression analysis

B = value determined by regression analysis

Equation 1 is not a linear equation. However, taking logarithms of both sides yields a linear equation as shown in equations 2 and 3.

$$\text{Log}_{10} Y = \text{Log}_{10} AX^B \quad (2)$$

$$\text{so } y = a + bx \quad (3)$$

where

$$y = \text{Log}_{10} Y$$

$$x = \text{Log}_{10} X$$

$$a = \text{Log}_{10} A$$

$$\text{and } b = B$$

Equation 3 is a linear regression equation. Using the correlation analysis method (13, 14) and the logarithmic transformations of the data extracted from the DD 1499's, Table 9 shows the correlation matrix for the nine transformed variables. The nine variables in Table 9 are named down the first column and listed by number across the top of the table. The r^2 for Variable 1 (contractor cost) and Variable 3 (negotiated cost), for example, is .996. Only the upper diagonal values are shown since the lower diagonal values are the same for the corresponding sets of values (e.g., r^2 for variables 1 and 4 is the same as r^2 for variables 4 and 1). From this table, then, it can be concluded that all of the variables are

very strongly related, thus confirming the observation that the costs are related to the contractor's proposal through the Weighted Guidelines process.

TABLE 9. CORRELATION ANALYSIS OF COST, PROFIT, AND PRICE

<u>Variable</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
1 = Contractor Cost	1.0	.992	.996	.957	.949	.946	.999	.992	.996
2 = Cost objective		1.0	.995	.946	.956	.941	.992	.999	.994
3 = Negotiated Cost			1.0	.954	.953	.950	.992	.994	.999
4 = Contractor Profit				1.0	.973	.981	.963	.950	.959
5 = Profit Objective					1.0	.978	.954	.961	.957
6 = Negotiated Profit						1.0	.951	.946	.956
7 = Contractor Price							1.0	.992	.996
8 = Price Objective								1.0	.994
9 = Negotiated Price									1.0

Using the non-linear model of equation 1, Figures G1 through G6 demonstrate the distribution of the differences between predicted (forecasted) values and actual values. A minus error (third column value) indicates that the forecasted value was less than the actual and a positive error indicates that the forecasted values was greater than the actual. The prediction model, the variables, A and B parameters, R-square, and factors are shown on the graphs. Using Figure G1 for example, one can observe that the model correctly predicted the actual negotiated costs on 999 contracts within plus and minus five percent 54.94% (.1541 + .3953 in %) of the time.*

*For Figure G1, the values .1541 and .3953 represent the frequency with which the error was from -5% to (but not including) 0% and from 0% (but not including) 5%, respectively.

Similarly, the model was accurate to within plus or minus ten percent 84.06 (.0780 + .1541 + .3953 + .2132 in %) of the time. In order to facilitate the comparison and discussion of the graphs, some of the data has been extracted and is shown in Table 10.

TABLE 10. PREDICTION MODEL SUMMARY

<u>Dependent Variable (Y)</u>	<u>Independent Variable (X)</u>	<u>A</u>	<u>B</u>	<u>r²</u>	<u>% Predictions</u>	
					<u>w/1 5%</u>	<u>w/1 10%</u>
Negotiated Cost	Contractor Cost	1.31395	.97628	.986	54.94	84.06
Cost Objective	Contractor Cost	1.28653	.97451	.980	23.81	68.35
Negotiated Price	Contractor Cost	1.41560	.97733	.985	53.34	83.26
Price Objective	Contractor Cost	1.38370	.97521	.980	29.32	66.94
Negotiated Profit	Contractor Cost	0.11230	.97885	.930	17.00	30.00
Profit Objective	Contractor Cost	0.10155	.97700	.924	12.00	27.30

NOTE: Model is $Y = AX^B$ and $X =$ Contractor Proposed Cost.

Using the prediction model in Table 10 for the negotiated cost, for example, the model was accurate to within 5% error 54.94% of the time and it was accurate to within 10% error 84.06% of the time. Notice, however, that the accuracy of predicting the Government's cost objective is somewhat lower than the accuracy of predicting the negotiated cost. Using the prediction model for the negotiated price, the model was accurate to within 5% error 53.34% of the time and it was accurate to within 10% error 83.26% of the time (for a total of 999 predictions). Accuracy of predicting profit, on the other hand, is not as good, even though the r^2 value is good.

It should be noted that use of this model ($Y = AX^B$) results in a sliding

scale of multiplicative percents which can be applied to the contractor cost proposals. The multiplicative percents are shown in Table 11.

TABLE 11. SLIDING SCALE COST FACTORS

COSTS IN MILLIONS	NEGOTIATED COST FACTOR	COST OBJECTIVE FACTOR	NEGOTIATED PRICE FACTOR	PRICE OBJECTIVE FACTOR	NEGOTIATED % PROFIT FACTOR	% PROFIT OBJECTIVE FACTOR
.1	100.00	95.93	109.04	104.01	8.80	7.79
.2	98.36	94.25	107.34	102.24	8.67	7.67
.5	96.25	92.08	105.13	99.95	8.51	7.51
.7	95.33	91.13	104.17	98.95	8.44	7.44
1.0	94.68	90.46	103.50	98.24	8.38	7.39
5.0	91.13	86.83	99.79	94.40	8.10	7.12
10.0	89.65	85.31	98.23	92.79	7.99	7.01
15.0	88.79	84.43	97.33	91.86	7.92	6.94
25.0	87.72	83.34	96.21	90.71	7.83	6.86
50.0	86.29	81.88	94.71	89.16	7.72	6.75
100.0	84.88	80.45	93.24	87.64	7.61	6.65
200.0	83.50	79.04	9.78	86.15	7.50	6.54
250.0	83.06	78.59	91.32	85.68	7.46	6.51
500.0	81.70	77.21	89.89	84.22	7.35	6.41
750.0	80.92	76.42	89.07	83.37	7.29	6.35

The interpretation of Table 11 is best explained by an example as follows: If the contractor proposed one million dollars, the negotiated cost could be determined by multiplying the sliding scale factor for negotiated cost by one million and dividing by 100%. For this example, then, the negotiated

cost would be 94.68 times one million divided by 100%, giving \$946,800. Similarly, the Government cost objective would be 90.46 times one million dollars divided by 100%, giving \$904,600. The price and profit values can be determined in a similar manner. The implication of this table is, then, that the higher the cost proposal of the contractor, the lower the adjustment (sliding scale factor). This adjustment is the percentage of the cost which the Government did not reduce through the negotiation process. Thus, the percentage reduction attributed to the negotiation (the savings due to negotiation) is 100% minus the sliding scale factor. For the one million dollar example, the savings due to negotiation is 100% - 94.68%, or 5.32%.

It should be noticed that some of the sliding scale factors are more than 100%. Because the model uses contractor cost as the independent variable, the factors greater than 100% simply means that the price resulting from a cost proposal of \$200,000, for example, would be negotiated for \$214,680 (107.34% times \$200,000 divided by 100%). Caution should be exercised in using these factors to assure that the predictions do not extend to contractor proposed costs too far out of the range of costs shown in Table 11 because the data of this analysis cannot substantiate the values outside of the ranges shown therein.

The graphs of the differences between forecasted and actual values have been included (and summarized in Table 10) to validate the prediction ability. However, more validation will be provided in the next section to illustrate that the model returns forecasted values which are consistent with the normative data in Chapter III. This will be illustrated with an example in the next section.

C. AN EXAMPLE OF PREDICTION

To demonstrate that the prediction models are consistent with the data of Chapter III, consider the following example:

1. Contractor Proposed Cost = \$1 million
Contractor Proposed Profit = \$100,000
then Contractor % Profit = 10%
and Contractor Price = \$1,100,000
2. From Table 11, the Sliding Scale factor = 94.68 for the Negotiated Cost.
From Table 11, the Sliding Scale factor = 103.5 for the Negotiated Price.
3. The Negotiated Cost Estimate is:
 $94.68 * \$1 \text{ million} + 100\% = \$946,800.$
4. The Negotiated Price Estimate is:
 $103.5 * \$1 \text{ million} + 100\% = 1,035,000.$
5. The Profit Estimate is:
 $\$1,035,000 - \$946,800 = \$88,200.$
6. The Percent Profit is: 9.32%.
7. Thus, the contractor received 88200/100000%, or 88.2% of the profit proposed.
8. An alternative way to determine percent profit is to use the Negotiated Profit Factor of Table 11 (8.38). This results in a profit of 8.38% times \$1 million or 83,800.
9. The \$83,800 from 8. is 83.8% of the profit proposed.

The differences between the profit estimates in steps 5 and 8 of the example are attributed to the errors of prediction shown in Table 10. As shown in Table 10, when predicting profit, the prediction is within 10% of the actual value in 30% of the predictions. However, the prediction in 5 is based upon differences in price and cost predictions. The important thing to remember is that price, cost, and profit are correlated variables. Errors associated with one prediction is increased when arithmetic operations are performed upon correlated variables. Step 3 represents the best estimate of the negotiated cost. Similarly, Step 4 represents the best estimate of the negotiated profit. However, this calculation involves the use of two correlated variables, and therefore, the error in estimating the profit is increased beyond the error of the individual terms. The predictions cannot be taken as absolute. The purpose of illustrating the error terms in Table 10 is to show that one should expect the actual values to differ from the predicted values. However, the differences should be within 10% of the actual value about 81% of the time for negotiated cost estimates (see Table 10). The estimates are the most likely estimate based upon the data available.

Finally, inspection of Table 13 shows that there is a reduction in percent profit ranging from 85 to 90 percent reduction due to the negotiation process. In both sets of calculations (steps 7 and 9), the reductions of contractor proposed profit to negotiated percent profit falls within this range (88.2% and 83.8% for steps 7 and 9, respectively).

D. SUMMARY OF CHAPTER IV ANALYSIS.

The graphs, figures, tables, and analysis of this chapter have attempted to demonstrate that the results of using the Weighted Guidelines process is predictability of the Government objective and negotiated result. The major

finding is that the Government's objective and the negotiated cost, price, and profit are related to the contractor's proposed cost (Table 10). Having determined as appropriate predictive model, sliding scale factors were developed which can be multiplied by the contractor cost proposal to predict cost, price, and profit values of the Government's objective and negotiated values. These factors are intended to simplify the calculations involved in using the prediction model.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL.

The Weighted Guidelines policy was intended to give the negotiator a set of procedures which would provide a common methodology for determining profit. The policy also provides an explicit evaluation methodology to the contractor, thus providing the contractor with the same evaluation criteria which the negotiator uses in evaluating a proposal. The logic of the policy is simple: list all of the factors which DOD wants to reward with profit dollars, weight them using DOD's relative reward factors, and determine a target profit objective for a given contract. However, the policy also states that each individual contract is to be evaluated on its individual merit and provides an allowable range of weights for each profit factor. The negotiator then is to determine the appropriate weight to be applied to each profit factor, depending upon the specific circumstances of the proposal.

A problem in using the policy now begins to materialize. Previous research and experts consulted in this research indicate that negotiators are not taking full advantage of the flexibility of the WGL's in developing profit objectives. Instead, it is claimed that negotiators start with a target profit which can be arrived at by simply using the medians of the allowable range of the profit factors and adjusting the values somewhat to arrive at an individual set of profit figures. Whether developed by habit or derived from the perception that the DOD does not actually condone taking full advantage of the allowable profit ranges, the conservative practice of starting from the medians of allowable ranges has led to narrow profit ranges and predictability of results by contractors.

This study set out to examine issues in terms of hard empirical evidence of contractual results tempered by previous research and expert opinion. The study has shed some light on the hypothesized areas by a rigorous analysis of the data. The following sections are the conclusions which are supported by this analysis and the specific recommendations that are suggested by the conclusions.

B. CONCLUSIONS.

1. The policy of Weighted Guidelines seems to be adhered to when viewed from the average weights alone. However, the intent of the policy is not being adhered to in view of the following evidence:

(a) From the figures in Appendix A, over fifty percent of the weights for the individual profit items fall within 0.5% of the medians, even though a much wider range of values is allowed by the DAR.

(b) Each individual contract is to be evaluated on its own merits; yet, the percent profit objective is primarily a function of the type of contract. Specifically, within various profit items, several factors are significant, but when the total percent objective is arrived at, only type of contract is significant.

(c) The analysis of "Degree Itemized" further supports the contention of targets for percent profit in cost type contracts. If such targets do exist, this contradicts the intent of policy.

(d) The Defense profit policy is concerned primarily with profit items, yet as Chapter IV shows, the Government's cost, price, and profit objectives (and negotiated outcomes) are influenced more by the contractor's proposal than the individual profit items of the DAR.

2. Predictability can lead to manipulation of negotiation outcomes. The following example illustrates this conclusion:

The final negotiated costs can be predicted to within +10% with a probability of about .84. Thus, the contractor may raise his costs by about 10% to assure that the negotiated costs come out where the absolute minimum cost is desired. By doing so, the contractor goes into negotiation with only an 8% probability that the costs will go below what he wanted as a minimum. ($1 - .84 = .16$ is the probability of costs being higher or lower. Thus, the probability of going lower is $.16/2$ or .08). By increasing costs by about 10%, the contractor is not likely to be found to have excessive cost estimates, but has assured itself of getting the minimum amount. The point is, then, that the Government is the only one who is negotiating what part of the added 10% the contractor gets. Additionally, the contractor will also get a predictable percent profit, depending only on the type of contract. As suggested in Chapter I, the contracting officers lack specific information to effectively challenge these costs. Also, for certain cost type contracts, this policy encourages inefficiencies since the contractor is "compelled" to spend the money. The problem: predictability encourages manipulation to achieve certain goals.

3. There is some evidence to suggest that certain "thresholds" of percent profit exist in the minds of negotiators (at least in cost-type contracts). Also, it appears that the DAR emphasizes percent profit to the

detriment of concern for cost. However, as shown in Chapter III, the cost, price and profit are relatively insensitive to the individual profit items which were carefully developed to help negotiators make up their pricing objectives. Controlling cost is a more effective means of controlling price and profit than isolated emphasis on profit. (This is also discussed in Chapter V of reference 6 and the conclusions in reference 15).

4. There appears to be not only a "threshold" of percent profit, but also a percent profit ceiling in the perceptions of Army negotiators. For example, it was observed in Chapter III that various profit items are significant factors if considering them individually. However, when considering the total percent profit, only the type of contract is significant. This suggests that one element may be raised, while a compensating lower value is used in another element. The result is, then, a percent profit which is insensitive to all of the DD 1499 profit items with the single exception of type of contract. This observation was also seen expressed by other reports (see Chart 7 of reference 16, for example). If this percent profit ceiling is operating, it should be observed in the FY80 data. Recall that Chapter II, Table 1, shows a change in the DAR which significantly alters the percent profit for Capital Investment. Unless the hypothesized ceiling is changed, it is expected that the capital investment values will increase (on the average), but there will appear a corresponding off-setting value elsewhere, resulting in the same percent profits before the policy took effect.

C. RECOMMENDATIONS.

1. Policy makers should:

(a) Explicitly state their goals in the Weighted Guidelines policy. As currently used, the concept lacks credibility because of the perceived limits on profit. The continued use of implicit goals results in predictability and circumvention of actual policy intent.

(b) Consider evidence, based upon analysis, to accomplish the stated goals. It appears that many studies have shown difficulties in implementing the policy (4, 5, 7, 16, 17, 18, 19, 20, 21, for example), yet few significant changes have resulted. The feedback mechanisms (the DD 1499 data base and various studies on WGL) appear to have little impact on policy making. Additionally, it appears that changes are not brought about in a timely manner as evidenced by the brief discussion in Chapter II of the shrunken industrial base.

(c) Determine a better measure of effectiveness (or criterion variable) than percent profit. This could be rate of return, for example.

(d) Analyze the FY80 data to see if the change in profit item discussed in Chapter II actually results in the predicted change.

2. Procurement managers.

(a) It is recommended that contracting officers and negotiators have access to historical data which has been "scrubbed" to verify its accuracy. This could be an automated data base on cost and pricing data for items similar to those which the contracting officer is involved with. COPPER IMPACT (22), a system which provides for the development of cost proposal models, data banks of pricing information such as labor and overhead rates, and analytical programs such as regression analysis, may be the starting point to help in the automation needs of negotiation. Programs and data bases should be configured for the specific user, incorporating the

features of a data base management system with few (but powerful) instructions required to use the system.

(b) It is recommended that contracting officers have more direct access to the specialists involved in the various fields that impact on contracting. This would assist in obtaining specific information for negotiating away from certain values depending on various interim negotiation results. When accurate historical data and specialists are available to the contracting officers, this will enable the contracting officer to develop an independent estimate of costs and profits. This independent estimate could be used as a means of developing specific objectives for negotiation if the contractor's proposal and independent estimate are too different.

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APPENDIX A

**WEIGHTED GUIDELINES
PROFIT FACTORS**

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 CHAPN 2: ITEM 12-A(2) ENGINEERING DIRECT LABOR.

ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS:
 TYPE JP ACTION(S)
 DEPARTMENT(S)

INITIAL
 ARMY

1.000 I 10.50 I
 1.000 I 17.50 I
 1.000 I 16.50 I
 1.000 I 15.50 I

.972	I	14.50	I	.0277
.778	I	15.50	I	.1900
.006	I	12.50	I	.2316
.003	I	11.50	I	.0027
.021	I	10.50	I	.0625
.014	I	9.50	I	.0069
.014	I	8.50	I	
.014	I	7.50	I	
.007	I	6.50	I	.0069
.007	I	5.50	I	
.007	I	4.50	I	
.007	I	3.50	I	
.007	I	2.50	I	
.007	I	1.50	I	
.000	I	.50	I	.0069
.000	I	.50	I	

THE MEAN IS 12.517 THE STAN DEV IS 1.399
 THE MEDIAN IS 15.125 THE MODE IS 12.000
 LARGEST VALUE IS 15.000 SMALL VALUE IS 1.300
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 164

FIGURE A2. ENGINEERING DIRECT
 LABOR PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 GRAPH 58 ITEM 12.A13) MANUFACTURING OVERHEAD.

SELECTED FACTORS:
 TYPE OF ACTION(S) INITIAL
 DEPARTMENT(S) ARMY

1.000	I	9.50	I	
1.000	I	9.00	I	
1.000	I	8.50	I	
1.000	I	8.00	I	
1.000	I	7.50	I	
.982	I	7.00	I	.0183
.927	I	6.50	I	.0550
.786	I	6.00	I	.1467
.613	I	5.50	I	.3669
.655	I	5.00	I	.3577
.637	I	4.50	I	
.699	I	4.00	I	.8275
.000	I	3.50	I	.0091
.000	I	3.00	I	
.000	I	2.50	I	
.000	I	2.00	I	
.000	I	1.50	I	
.000	I	1.00	I	
.000	I	.50	I	
.000	I	.50	I	

THE MEAN IS 5.612 THE STAN DEV IS 1.536
 THE MEDIAN IS 5.785 THE MODE IS 7.500
 LARGEST VALUE IS 7.400 SMALL VALUE IS 3.900
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 109

FIGURE A5. MANUFACTURING OVERHEAD
 PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 CHAPM 61 ITEM 12.A(4) OTHER COSTS.

SELECTED FACTORS: TYPE OF ACTION(S) DEPARTMENT(S)	INITIAL ARMY	ASSIGNED WEIGHT (PERCENT PROFIT)
.966 I >	9.50 [#####]	.0300
.959 I	9.00 [#####]	.0060
.950 I	8.50 [#####]	
.938 I	8.00 [#####]	.0206
.897 I	7.50 [#####]	.0413
.888 I	7.00 [#####]	.0982
.784 I	6.50 [#####]	.0620
.717 I	6.00 [#####]	.0689
.690 I	5.50 [#####]	.0275
.545 I	5.00 [#####]	.1480
.503 I	4.50 [#####]	.0413
.469 I	4.00 [#####]	.0304
.386 I	3.50 [#####]	.0027
.276 I	3.00 [#####]	.1103
.131 I	2.50 [#####]	.1480
.069 I	2.00 [#####]	.0620
.041 I	1.50 [#####]	.0275
.021 I	1.00 [#####]	.0206
.007 I	.50 [#####]	.0137
.000 I <	.50 [#####]	.0060

THE MEAN IS 6.726 THE STAN DEV IS 2.740
 THE MEDIAN IS 4.466 THE MODE IS 5.250
 LARGEST VALUE IS 25.000 SMALL VALUE IS .200
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 105

FIGURE A6. OTHER COSTS
 PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 CHAPM 73 ITEM 12.A(5) GENERAL MANAGEMENT G&A.
 ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS: TYPE OF ACTION(S) DEPARTMENT(S)	INITIAL ARMY
1.000 I >	9.50 I
1.000 I	9.00 I
1.000 I	8.50 I
.974 I	8.00 I
.895 I	7.50 I
.562 I	7.00 I
.007 I	6.50 I
.007 I	6.00 I
.007 I	5.50 I
.007 I	5.00 I
.007 I	4.50 I
.007 I	4.00 I
.007 I	3.50 I
.007 I	3.00 I
.007 I	2.50 I
.007 I	2.00 I
.007 I	1.50 I
.007 I	1.00 I
.000 I	.50 I
.000 I	.50 I

INITIAL
ARMY
0.0263
0.0789
0.5328
0.3552

THE MEAN IS 7.015
 THE MEDIAN IS 7.292
 LARGEST VALUE IS 8.000
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 152

THE STAN DEV IS .501
 THE MODE IS 7.250
 SMALL VALUE IS .600

FIGURE A7. GENERAL MANAGEMENT G&A
 PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEARS 1979,
 GRAPH OF ITEM 12.A(7) TOTAL CONTRACTOR EFFORT (ADJUSTED) *
 ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS: TYPE OF ACTION(S) DEPARTMENT(S)	INITIAL ARMY	
1.000 I >	9.50 I	
1.000 I	9.00 I	
1.000 I	8.50 I	
1.000 I	8.00 I	
1.000 I	7.50 I	
.987 I	7.00 I	.0130
.935 I	6.50 I	.0522
.883 I	6.00 I	.0915
.712 I	5.50 I	.1307
.562 I	5.00 I	.1503
.412 I	4.50 I	.1503
.255 I	4.00 I	.1500
.092 I	3.50 I	.1633
.046 I	3.00 I	.0457
.013 I	2.50 I	.0326
.007 I	2.00 I	.0065
.000 I	1.50 I	.0065
.000 I	1.00 I	
.000 I	.50 I	
.000 I <	.50 I	

THE MEAN IS	1	2	3	4	5	6	7	8	9	10
THE MEDIAN IS	4.776									
LARGEST VALUE IS	4.806									
SMALL VALUE IS	7.200									
NUMBER OF NON-ZERO RECORDS IN ABOVE DATA	133									

FIGURE A8. TOTAL CONTRACTOR EFFORT
 (ADJUSTED)

WEIGHTED GUIDELINES PROFIT FACTORS. FISCAL YEAR 1979.
 GRAPH 9: ITEM 12.0 RISK.

ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS:
 TYPE OF ACTION(S)
 DEPARTMENT(S) INITIAL
 ARMY

1.000	I	>	9.50	I		
1.000	I		9.00	I		
1.000	I		8.50	I		
.965	I		8.00	I		.0347
.904	I		7.50	I		.0600
.774	I		7.00	I		.1304
.704	I		6.50	I		.0695
.617	I		6.00	I		.0809
.539	I		5.50	I		.0702
.504	I		5.00	I		.0347
.461	I		4.50	I		.0434
.415	I		4.00	I		.0260
.417	I		3.50	I		.0173
.391	I		3.00	I		.0260
.322	I		2.50	I		.0695
.278	I		2.00	I		.0434
.235	I		1.50	I		.0434
.130	I		1.00	I		.1043
.035	I		.50	I		.0956
.000	I	<	.50	I		.0347

THE MEAN IS 4.317 THE STAN DEV IS 2.504
 THE MEDIAN IS 4.957 THE MODE IS 7.250
 LARGEST VALUE IS 8.000 SMALL VALUE IS .200
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA 115

FIGURE A9. RISK PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS. FISCAL YEAR=1979.
 CHAP 91 ITEM 12.0 RISK. ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS:
 CONTRACT TYPE(S) FFP FP(E) FPI FPR
 DEPARTMENT(S) ARMY

CONTRACT TYPE(S)	DEPARTMENT(S)	FFP	FP(E)	FPI	FPR
1.000	I	9.50	I		
1.000	I	9.00	I		
1.000	I	6.50	I		
.952	I	6.00	I	.0000	
.856	I	7.50	I	.0960	
.688	I	7.00	I	.1600	
.568	I	6.50	I	.1200	
.424	I	6.00	I	.1400	
.304	I	5.50	I	.1200	
.240	I	5.00	I	.0630	
.176	I	6.50	I	.0630	
.088	I	6.00	I	.0880	
.064	I	3.50	I	.0240	
.040	I	3.00	I	.0240	
.016	I	2.50	I	.0240	
.008	I	2.00	I	.0070	
.000	I	1.50	I	.0070	
.000	I	1.00	I		
.000	I	.50	I		
.000	I	.50	I		

FFP

FPI

THE MEAN IS 5.982 THE STAN DEV IS 1.414
 THE MEDIAN IS 6.373 THE MODE IS 7.250
 LARGEST VALUE IS 9.500 SMALL VALUE IS 1.000
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA = 125

FIGURE A10. RISK (PRICE CONTRACTS)
 PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS. FISCAL YEAR=1979.
 GRAPH 91 ITEM 12.0 RISK. ASSIGNED HEIGHT (PERCENT PROFIT)

SELECTED FACTORS: CONTRACT TYPE(S) DEPARTMENT(S)	CPAF	CPFF	CPIF
1.000 I >	9.50		
1.000 I	9.00		
1.000 I	8.50		
1.000 I	8.00		
1.000 I	7.50		
1.000 I	7.00		
1.000 I	6.50		
1.000 I	6.00		
1.000 I	5.50		
1.000 I	5.00		
1.000 I	4.50		
.989 I	4.00	.0114	
.977 I	3.50	.0114	
.954 I	3.00	.0229	
.805 I	2.50	.0609	
.782 I	2.00	.1036	
.644 I	1.50	.1379	
.616 I	1.00	.2288	
.161 I	.50	.3348	
.000 I <	.50	.1699	

	1	2	3	4	5	6	7	8	9	10
THE MEAN IS										
THE MEDIAN IS	1.510									
LARGEST VALUE IS	1.321									
NUMBER OF NON-ZERO RECORDS IN ABOVE DATA	0.400									

CPIF
 CPFF

FIGURE A11. RISK (COST CONTRACTS)
 PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 GRAPH 101 ITEM 12.C CAPITAL EMPLOYED.
 ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS: TYPE OF ACTION(S)	INITIAL DEPARTMENT(S)	ASSIGNED WEIGHT (PERCENT PROFIT)
.967 I	ARMY	.0320
.967 I	ARMY	.0320
.934 I	ARMY	.0320
.599 I	ARMY	.0320
.270 I	ARMY	.0320
.211 I	ARMY	.0592
.151 I	ARMY	.0592
.112 I	ARMY	.0394
.066 I	ARMY	.0660
.066 I	ARMY	.0660
.059 I	ARMY	.0665
.066 I	ARMY	.0131
.066 I	ARMY	.0350
.066 I	ARMY	.0300
.066 I	ARMY	.0250
.039 I	ARMY	.0665
.039 I	ARMY	.0350
.039 I	ARMY	.0300
.000 I	ARMY	.0394
.000 I	ARMY	.0350

THE MEAN IS 7.52 THE STAN DEV IS 1.664
 THE MEDIAN IS 7.725 THE MODE IS 6.250
 LARGEST VALUE IS 10.200 SMALL VALUE IS .600
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 152

FIGURE A12. CAPITAL EMPLOYED
 PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS. FISCAL YEAR 1979.
GRAPH 11: ITEM 12.0 PRODUCTIVITY.
ASSIGNED WEIGHT (PERCENT PROFIT)
SELECTED FACTORS: INITIAL
TYPE OF ACTION(S) ARMY
DEPARTMENT(S)
NUMBER OF NON-ZERO RECORDS IN ABOVE DATA 0

FIGURE A13. PRODUCTIVITY PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR=1979.
 GRAPH 121 ITEM 12.E INDEPENDENT DEVELOPMENT.
 ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS: TYPE OF ACTION(S) DEPARTMENT(S)	INITIAL ARMY
1.000 I >	0.50 I
1.000 I	9.00 I
1.000 I	0.50 I
1.000 I	0.00 I
1.000 I	7.50 I
1.000 I	7.00 I
1.000 I	6.50 I
1.000 I	6.00 I
1.000 I	5.50 I
1.000 I	5.00 I
1.000 I	4.50 I
1.000 I	4.00 I
1.000 I	3.50 I
1.000 I	3.00 I
1.000 I	2.50 I
.500 I	2.00 I
.500 I	1.50 I
.500 I	1.00 I
.000 I	.50 I
.000 I <	.50 I

1	2	3	4	5	6	7	8	9	10
THE MEAN IS	1.500	THE STAN DEV IS	0.600						
THE MEDIAN IS	.500	THE MODE IS	2.250						
LARGEST VALUE IS	2.100	SMALL VALUE IS	.900						
NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS	2								

FIGURE A14. INDEPENDENT DEVELOPMENT
 PERCENT PROFIT

WEIGHTED SUBSIDIZED PROFIT FACTORS. FISCAL YEAR 1979.
GRAPH 13: ITEM 12.7 OTHER.

ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS:
TYPE OF ACTION(S)
DEPARTMENT(S).

INITIAL
ARMY

.025 1 9.50 [.....] .0769

.000 1 9.00 [.....] .0769

.000 1 8.50 [.....]

.000 1 8.00 [.....]

.000 1 7.50 [.....]

.000 1 7.00 [.....]

.000 1 6.50 [.....]

.000 1 6.00 [.....]

.000 1 5.50 [.....]

.000 1 5.00 [.....]

.000 1 4.50 [.....]

.000 1 4.00 [.....]

.769 1 3.50 [.....] .0769

.530 1 3.00 [.....] .2307

.530 1 2.50 [.....]

.300 1 2.00 [.....] .2307

.150 1 1.50 [.....] .1530

.150 1 1.00 [.....]

.000 1 .50 [.....] .1530

.000 1 .50 [.....]

THE MEAN IS 3.077
THE MEDIAN IS 2.200
LARGEST VALUE IS 10.000
NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS

THE STAN DEV IS 4.250
THE MODE IS 3.250
SMALL VALUE IS .000

1 2 3 4 5 6 7 8 9 10

FIGURE A15. OTHER PERCENT PROFIT

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 GRAPH IS: RATIO OF ITEM 11.0 TO 11.C
 ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS: CONTRACT TYPE(S) TYPE OF ACTION(S) DEPARTMENT(D)	FPF	FP(C)	FP(I)	FP(A)
.990 I >	16.50	16.0097		
.990 I	17.50			
.990 I	16.50			
.990 I	15.50			
.990 I	14.50			
.932 I	13.50	.0502		
.746 I	12.50	.1359		
.631 I	11.50	.1650		
.408 I	10.50	.2233		
.175 I	9.50			
.058 I	8.50	.1165		
.010 I	7.50	.0485		
.000 I	6.50	.0097		
.000 I	5.50			
.000 I	4.50			
.000 I	3.50			
.000 I	2.50			
.000 I	1.50			
.000 I	.50			
.000 I <	.50			

THE MEAN IS 11.097 THE STAN DEV IS 2.363
 THE MEDIAN IS 11.146 THE MODE IS 10.000
 LARGEST VALUE IS 20.900 SMALL VALUE IS 7.200
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 103

FIGURE A17. PERCENT PROFIT FOR PRICE CONTRACTS

WEIGHTED GUIDELINES PROFIT FACTORS, FISCAL YEAR 1979.
 GRAPH 15: RATIO OF ITEM 11.0 TO 11.C
 ASSIGNED WEIGHT (PERCENT PROFIT)

SELECTED FACTORS: CONTRACT TYPE(S) TYPE OF ACTION(S) DEPARTMENT(S)	CPAF	CPFF	CPIF
INITIAL ARMY			
.063 I >	9.50		
.034 I	9.00	.0367	
.031 I	0.50	.0294	
.728 I	0.00		.1029
.040 I	7.50		.1029
.012 I	7.00		.0062
.265 I	6.50		.1470
.191 I	6.00		.0735
.125 I	5.50		.0661
.000 I	5.00	.0367	
.001 I	6.50	.0073	
.059 I	6.00	.0220	
.051 I	3.50	.0073	
.022 I	3.00	.0294	
.015 I	2.50	.0073	
.007 I	2.00	.0073	
.000 I	1.50	.0073	
.000 I	1.00		
.000 I	.50		
.000 I <	.50		

THE MEAN IS 6.907
 THE MEDIAN IS 7.322
 LARGEST VALUE IS 10.500
 NUMBER OF NON-ZERO RECORDS IN ABOVE DATA IS 136

FIGURE A18. PERCENT PROFIT FOR
 COST CONTRACTS

APPENDIX B

**PERCENT PROFIT
AVERAGE SUMMARY**

TABLE B1. PERCENT PROFIT (MATERIAL)

PERCENT PROFIT AVERAGE SUMMARY SELECTED FACILITIES: TYPE OF ACTION(S)		INITIAL	1977				1978				1979			
DEPARTMENT(S)	ARMY	ARMY	FISCAL	NUM	STANDARD	FISCAL	NUM	STANDARD	FISCAL	NUM	STANDARD	FISCAL	NUM	STANDARD
NO. CATEGORY		MATERIAL	1977	NUM	DEVIATION	1978	NUM	DEVIATION	1979	NUM	DEVIATION	1979	NUM	DEVIATION
12.A(1)	MATERIALS		2.97	59	.00	3.01	55	.09	3.02	70	.09	3.02	70	.09
12.A(2)	ENGINEERING DIRECT LABOUR		10.24	49	6.06	11.16	51	3.06	11.06	71	3.07	11.06	71	3.07
	ENGINEERING OVERHEAD		6.19	49	2.02	6.76	71	2.02	6.76	71	2.02	6.76	71	2.02
12.A(3)	MANUFACTURING DIRECT LABOUR		6.08	54	2.13	6.58	50	4.39	6.58	71	4.39	6.58	71	4.39
	MANUFACTURING OVERHEAD		5.04	54	1.38	4.44	50	1.79	4.44	72	1.79	4.44	72	1.79
12.A(4)	UTMEN		3.08	45	5.29	4.26	50	2.48	4.26	71	2.48	4.26	71	2.48
12.A(5)	G & A		6.00	59	.26	6.74	55	1.29	6.74	79	1.29	6.74	79	1.29
.....														
12.A(7) CURTAINMENT TOTAL EFFORT			3.90	59	.86	3.80	56	.91	3.80	79	.85	3.80	79	.85
(SUM OF ABOVE)														
.....														
12.B	RISK		5.54	53	2.44	5.11	55	2.49	4.92	74	2.49	4.92	74	2.49
12.C	CAPITAL EMPLOYED		7.64	59	1.20	7.59	55	1.05	7.61	74	1.05	7.61	74	1.05
12.D	PRODUCTIVITY		.00	0	.00	.25	1	1.75	.00	0	.00	.00	0	.00
12.E	INDEPENDENT DEVELOPMENT		.07	3	.32	.06	3	.30	.03	1	.30	.03	1	.30
12.F	UTMEN		.45	7	1.53	.48	7	1.31	.59	11	1.31	.59	11	1.31
.....														
SUM OF AVERAGES OF														
12.1(7) THRU 12.F ABOVE			17.39	59	3.00	17.28	56	4.20	16.82	79	3.73	16.82	79	3.73
.....														
TOTAL PROFIT OBJECTIVE														
(ITEM 11.0/11.C)			9.89	93	2.70	9.62	87	4.40	9.97	110	2.94	9.97	110	2.94
.....														

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE B2. PERCENT PROFIT (SERVICES)

PERCENT PROFIT AVERAGE SUMMARY SELECTED FACTORS	TYPE OF ACTIVITY	INITIAL	ARMY	SERVICES	1977		1978		1979		STANDARD DEVIATION	NUM	STANDARD DEVIATION	NUM	STANDARD DEVIATION
					FISCAL	STANDARD DEVIATION	FISCAL	STANDARD DEVIATION	FISCAL	STANDARD DEVIATION					
1000 PROFIT FACTOR															
12.A(1) MATERIALS		2.59	1.24	2.58	0	1.45	2.95	2.95	2.95	2.95	2.95	29	1.19	2.95	2.95
12.A(2) ENGINEERING DIRECT LABOR		11.02	2.94	12.48	6	.86	12.18	12.18	12.18	12.18	12.18	21	1.04	12.18	12.18
12.A(3) ENGINEERING OVERHEAD		7.36	1.75	7.01	6	.27	7.31	7.31	7.31	7.31	7.31	21	1.04	7.31	7.31
12.A(4) MANUFACTURING DIRECT LAB		4.39	3.03	1.67	2	2.91	3.90	3.90	3.90	3.90	3.90	11	4.00	3.90	3.90
12.A(5) MANUFACTURING OVERHEAD		2.95	2.83	1.55	2	4.54	2.07	2.07	2.07	2.07	2.07	10	2.96	2.07	2.07
12.A(6) OTHER		4.15	1.95	3.54	7	2.95	4.00	4.00	4.00	4.00	4.00	22	4.18	4.00	4.00
12.A(7) 6 0 A		7.02	.50	7.08	6	.53	7.08	7.08	7.08	7.08	7.08	22	.21	7.08	7.08
.....															
12.A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)		4.69	1.17	5.15	6	1.07	5.00	5.00	5.00	5.00	5.00	22	.70	5.00	5.00
.....															
12.B RISK		3.20	3.03	3.56	7	3.09	2.00	2.00	2.00	2.00	2.00	18	2.95	2.00	2.00
12.C CAPITAL EMPLOYED		7.05	2.07	7.34	6	2.63	7.28	7.28	7.28	7.28	7.28	22	1.05	7.28	7.28
12.D PRODUCTIVITY		.00	.00	.00	0	.00	.00	.00	.00	.00	.00	0	.00	.00	.00
12.E INDEPENDENT DEVELOPMENT		.09	1.40	.00	0	.00	.00	.00	.00	.00	.00	0	.00	.00	.00
12.F OTHER		.75	1.59	.63	1	1.65	.00	.00	.00	.00	.00	0	.00	.00	.00
.....															
SUM OF AVERAGES OF 12.B(1) THRU 12.F ABOVE		15.78	3.16	16.65	6	3.18	15.55	15.55	15.55	15.55	15.55	22	3.42	15.55	15.55
.....															
TOTAL PROFIT SUBJECTIVE (ITEM 11.0/11.C)		8.55	3.14	8.21	24	3.49	8.45	8.45	8.45	8.45	8.45	43	3.03	8.45	8.45

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE B3. PERCENT PROFIT (RES & DEV)

PERCENT PROFIT AVERAGE SUMMARY SELECTED FACTORS TYPE OF ACTION(S)	INITIAL	DEPARTMENT(S)	ARMY	RESDEV	1977		1978		1979		STANDARD DEVIATION
					FISCAL	STANDARD DEVIATION	FISCAL	STANDARD DEVIATION	FISCAL	STANDARD DEVIATION	
					NUM		NUM		NUM		
12.A(1) MATERIALS					27	.61	24	1.01	44	1.14	
12.A(2) ENGINEERING DIRECT LABOR					27	.75	25	.74	52	1.79	
12.A(3) ENGINEERING OVERHEAD					27	.40	25	.33	52	.36	
12.A(4) MANUFACTURING DIRECT LAB					14	3.00	12	3.75	27	3.91	
12.A(5) MANUFACTURING OVERHEAD					14	2.77	12	2.75	27	2.76	
12.A(6) OTHER					26	2.56	25	2.67	52	2.22	
12.A(7) G & A					27	.31	24	1.40	51	1.35	
.....											
12.A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)					27	.84	25	.99	52	.75	
.....											
12.B RISK					19	2.09	18	2.45	25	1.62	
12.C CAPITAL EMPLOYED					27	.76	25	2.00	51	1.49	
12.D PRODUCTIVITY					0	.00	0	.00	0	.00	
12.E INDEPENDENT DEVELOPMENT					1	.19	1	.10	1	.12	
12.F OTHER					0	.00	2	.65	2	.63	
.....											
SUM OF AVERAGES OF 12.A(7) THRU 12.F ABOVE					47	2.06	25	2.76	52	1.90	
.....											
TOTAL PROFIT OBJECTIVE (ITEM 11.0711.C)					49	1.84	53	1.72	86	1.63	

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE B4. PERCENT PROFIT (PRICE)

PERCENT PROFIT AVERAGE SUMMARY SELECTED FACTORS: CONTRACT TYPE(S)		FPF	FP(E)	FPI	FPR	1977		1978		1979	
TYPE OF ACTION(S)		INITIAL		FISCAL		STANDARD		FISCAL		STANDARD	
DEPARTMENT(S)		ARMY		NUM	DEVIATION	NUM	DEVIATION	NUM	DEVIATION	NUM	DEVIATION
1999 PROFIT FACTOR											
12-A(1)	MATERIALS	2.78	19.23	64	.77	53	.74	71	.88		
12-A(2)	ENGINEERING DIRECT LABOR	9.22	2.55	55	4.83	49	3.73	66	3.78		
	ENGINEERING OVERHEAD	6.72	2.45	61	2.45	47	2.55	62	2.70		
12-A(3)	MANUFACTURING DIRECT LAB	5.18	1.51	61	1.51	47	1.94	62	2.08		
	MANUFACTURING OVERHEAD	3.85	2.38	53	2.38	48	2.71	65	3.44		
12-A(4)	OTHER	6.92	.28	68	.28	53	1.31	73	.77		
12-A(5)	G & A										

12-A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)		3.85	6.6	66	.88	54	.87	73	.90		

12-B	RISK	6.14	1.32	66	1.32	54	1.41	73	1.51		
12-C	CAPITAL EMPLOYED	7.36	1.75	64	1.75	55	2.08	72	2.08		
12-D	PRODUCTIVITY	.80	.80	0	.80	1	1.77	0	.80		
12-E	INDEPENDENT DEVELOPMENT	.06	.31	3	.31	3	.50	1	.24		
12-F	OTHER	.38	1.25	7	1.25	7	1.30	6	2.69		

SUM OF AVERAGES UP 12-A(7) THRU 12-F ABOVE		17.80	2.75	66	2.75	54	3.92	73	3.59		

TOTAL PROFIT OBJECTIVE (SEE 11.9/11-C)		19.64	2.11	106	2.11	87	1.88	103	2.36		

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12-A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE B5. PERCENT PROFIT (COST)

PERCENT PROFIT AVERAGE SUMMARY		CPAF	CPFF	CPIF	1977		1978		1979		STANDARD	
SELECTED FACTORS:	CONTRACT TYPE(S)				FISCAL	MUM	STANDARD	FISCAL	MUM	FISCAL	MUM	DEVIATION
TYPE OF ACTION(S)	INITIAL				1977		DEVIATION	1978		1979		
DEPARTMENT(S)	ARMY											
1979 PROFIT FACTOR												
12.A(1) MATERIALS					5.16	89	.75	4.89	52	2.96	76	1.10
12.A(2) ENGINEERING DIRECT LABOR					14.80	41	1.05	12.49	35	12.26	70	2.37
12.A(3) ENGINEERING OVERHEAD					7.89	41	.48	7.49	35	7.46	78	1.30
12.A(4) MANUFACTURING DIRECT LAB					5.52	19	3.83	3.87	17	4.48	47	3.84
12.A(5) MANUFACTURING OVERHEAD					2.45	18	2.70	4.70	17	3.24	47	2.73
12.A(6) OTHER					5.11	36	5.97	4.41	34	4.27	80	2.40
12.A(5) b a					6.96	41	.37	6.85	54	6.89	79	.88
12.A(7) CONTRACTOR TOTAL EFFORT					5.28	41	.85	4.84	55	5.30	80	.79
(SUM OF ABOVE)												
12.B	WIRA				.53	22	.66	.74	24	.75	42	.94
12.C	CAPITAL EMPLOYED				6.00	41	.81	7.49	55	1.83	80	1.41
12.D	PRODUCTIVITY				.00	0	.00	.00	0	.00	0	.00
12.E	IMPLEMENTATION DEVELOPMENT				.07	2	.55	.01	1	.01	1	.10
12.F	OTHER				.91	5	1.22	.31	5	.13	5	.54
SUM OF AVERAGES OF					18.29	41	2.00	13.00	55	13.64	80	1.81
12.(17) THRU 12.F ABOVE												
TOTAL PROFIT OBJECTIVE					6.66	73	1.60	6.78	71	1.63	136	1.60
(ITEM 11.0/11.C)												

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-2500 ENTRIES FOR THE FISCAL YEAR TO THE LEFT. ALL AVERAGES ABOVE ARE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

APPENDIX C

PROFIT/SUBCOST (%) AVERAGE

TABLE C1. PROFIT/SUBCOST (MATERIAL)

PROFIT/SUBCOST (2) AVERAGE SUMMARY SELECTED FACTORS: TYPE OF ACTION(S)	INITIAL	DEPARTMENT(S)	ARMY	MATERIAL	1977	NUM	STANDARD DEVIATION	1978	NUM	STANDARD DEVIATION	1979	NUM	STANDARD DEVIATION
12.A(1) MATERIALS	1.12	37	.71	1.13	35	.76	1.09	76	.69				
12.A(2) ENGINEERING DIRECT LABOR	.07	42	1.17	.62	39	.91	1.05	64	1.15				
12.A(3) ENGINEERING OVERHEAD	.59	30	.86	.41	36	.67	.71	39	.66				
12.A(4) MANUFACTURING DIRECT LAB	.77	31	.24	.67	49	.52	.68	65	.58				
12.A(5) MANUFACTURING OVERHEAD	.96	31	.76	.97	49	.65	.77	66	.61				
12.A(6) OTHER	.10	10	.66	.66	26	1.04	.38	38	.74				
12.A(7) C & A	.89	30	.57	.78	32	.56	.67	79	.53				
12.A(7) CONTRACT TOTAL EFFORT (SUM OF ABOVE)	3.00	59	.66	3.00	56	.61	4.07	79	.65				
12.B WISA	5.30	33	2.48	3.11	33	2.48	4.92	74	2.53				
12.C CAPITAL EMPLOYED	.89	30	.89	.64	32	.57	.68	71	.67				
12.D PRODUCTIVITY	.06	6	.90	.01	1	.89	.06	4	.89				
12.E INDEPENDENT DEVELOPMENT	.07	3	.32	.06	3	.30	.03	1	.30				
12.F OTHER	.03	7	.15	.04	7	.12	.06	11	.12				
TOTAL PROFIT/SUBCOST (SUM OF ABOVE)	10.26	99	2.36	9.07	96	2.34	9.76	74	2.00				
TOTAL PROFIT/SUBCOST (ITEM 11.D/11.C)	9.09	93	2.70	9.62	87	2.69	9.97	110	2.94				

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR IN THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE C2. PROFIT/SUBCOST (SERVICES)

PROFIT/SUBCOST (A) AVERAGE SUMMARY SELECTED FACTORS: TYPE OF ACTION(S)	INITIAL DEPARTMENT(S)	ARMY	SERVICES	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
1499 PROFIT FACTOR												
12-A(1) MATERIALS		.03	15	.00		.79	6	.04		.42	14	.44
12-A(2) ENGINEERING DIRECT LABOR		2.19	19	2.02		2.21	6	1.30		2.90	20	1.72
12-A(3) ENGINEERING OVERHEAD		1.01	14	.94		1.31	6	.86		1.04	20	1.12
12-A(4) MANUFACTURING DIRECT LAB		.00	11	.01		.15	2	.05		.23	14	.23
12-A(5) MANUFACTURING OVERHEAD		.00	10	.02		.10	2	.49		.26	10	.08
12-A(6) OTHER		1.00	15	1.33		1.09	6	2.03		1.00	15	1.07
12-A(7) TOTAL		.01	20	.37		.33	6	.03		.75	22	.26
12-A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)		0.09	21	1.17		3.15	6	1.07		5.00	22	.70
12-B WASH		5.20	10	5.03		3.20	7	3.09		6.00	10	2.93
12-C CAPITAL EMPLOYED		.02	17	.74		.21	6	.23		.70	20	.02
12-D PRODUCTIVITY		.00	9	.00		.00	0	.00		.00	0	.00
12-E INVESTMENT DEVELOPMENT		.09	1	.00		.00	0	.00		.00	0	.00
12-F OTHER		.03	3	.07		.00	1	.10		.00	0	.00
TOTAL PROFIT/SUBCOST (SUM OF ABOVE)		0.03	21	2.05		0.90	6	3.20		0.96	22	2.73
TOTAL PROFIT/SUBCOST (ITEM 11.0/11.6)		0.55	37	3.14		0.21	20	3.07		0.45	43	3.03

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-2800 ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.0(17) FOR THE APPROPRIATE FISCAL YEAR.

TABLE C3. PROFIT/SUBCOST (RES & DEV)

PROFIT/SUBCOST (2) AVERAGE SUMMARY SELECTED FACTORS: TYPE OF ACTION(S)	INITIAL	DEPARTMENT(S)	ARMY	RESERVE	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
1999 PROFIT FACTOR													
12-A(1) MATERIALS					.70	27	.09	.70	43	.08	.03	42	.08
12-A(2) ENGINEERING DIRECT LABOR					3.01	27	1.27	2.00	20	1.30	3.32	32	1.20
12-A(2) ENGINEERING OVERHEAD					1.09	27	.05	1.79	20	1.00	2.10	32	.01
12-A(3) MANUFACTURING DIRECT LAB					.22	12	.31	.19	10	.09	.17	23	.20
12-A(3) MANUFACTURING OVERHEAD					.20	12	.30	.27	10	.37	.10	23	.31
12-A(4) OTHER					.33	17	.06	.20	11	.32	.29	27	.03
12-A(5) 6 0 A					.90	27	.02	.99	20	.33	.09	51	.35

12-A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)					3.27	27	.06	4.97	43	.99	3.51	32	.75

12-B WSA					1.07	19	2.09	1.77	10	2.03	.93	23	1.02
12-C CAPITAL EMPLOYED					.72	26	.01	.05	20	.31	.00	09	.31
12-D PRODUCTIVITY					.00	0	.00	.00	0	.00	.00	0	.00
12-E INDEPENDENT DEVELOPMENT					.00	0	.00	.02	1	.10	.02	1	.12
12-F OTHER					.00	0	.00	.01	2	.00	.00	1	.03

TOTAL PROFIT/SUBCOST (SUM OF ABOVE)					7.05	27	2.11	7.02	43	2.20	7.20	32	1.35

TOTAL PROFIT/SUBCOST (ITEM 11.0/11.C)					7.00	09	1.00	7.00	35	1.72	7.37	00	1.03

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12-A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE C4. PROFIT/SUBCOST (PRICE)

PROFIT/SUBCOST (S) AVERAGE SUMMARY SELECTED FACTORS CONTRACT TYPE(S)	PPP	FP(E)	PP	PPM
TYPE OF ACTION(S)	INITIAL			
DEPARTMENT(S)	ARMY			
1999 PROFIT FACTOR	FISCAL 1977	FISCAL 1978	FISCAL 1979	FISCAL 1979
	NUM DEVIATION	NUM DEVIATION	NUM DEVIATION	NUM DEVIATION
12.A(1) MATERIALS	1.01 03	1.11 51	1.02 09	1.02 09
12.A(2) ENGINEERING DIRECT LABOR	.01 49	1.11 51	1.23 59	1.00 00
12.A(2) ENGINEERING OVERHEAD	.54 45	.42 35	.75 54	.00 00
12.A(3) MANUFACTURING DIRECT LAB	.75 58	.61 47	.76 58	.03 03
12.A(3) MANUFACTURING OVERHEAD	.96 58	.97 47	.76 58	.03 03
12.A(4) OTHER	.59 45	.48 45	.43 39	.03 03
12.A(5) B & A	.05 04	.76 55	.05 05	.56 56

12.A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)	3.05 04	3.07 54	4.20 73	0.70 00

12.B RISK	0.16 04	0.17 54	0.08 73	1.51 00
12.C CAPITAL EMPLOYED	.05 02	.74 48	.56 04	.00 00
12.D PRODUCTIVITY	.00 0	.01 1	.00 0	.00 00
12.E INDEPENDENT DEVELOPMENT	.00 3	.06 3	.03 1	.04 04
12.F OTHER	.00 0	.04 7	.00 0	.00 00

TOTAL PROFIT/SUBCOST (SUM OF ABOVE)	10.96 04	10.75 54	10.97 73	1.07 00

TOTAL PROFIT/SUBCOST (ATEM 11.0/11.5)	10.00 100	10.55 07	11.10 103	2.50 00

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE C5. PROFIT/SUBCOST (COST)

PROFIT/SUBCOST (1) AVERAGE SUMMARY SELECTED FACTORS: CONTRACT TYPE(3)	CPAF	CPFF	CPIF	TYPE OF ACTION(2)	INITIAL	DEPARTMENT(2)	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1976	NUM	STANDARD DEVIATION	FISCAL 1975	NUM	STANDARD DEVIATION
12.A(1) MATERIALS							.70	26	.75	.60	51	.52	.67	63	.71
12.A(2) ENGINEERING DIRECT LABOUR							3.05	39	1.31	2.35	55	1.55	2.87	77	1.46
12.A(3) ENGINEERING OVERHEAD							1.76	39	.95	1.30	55	1.09	1.90	77	1.09
12.A(4) MANUFACTURING DIRECT LAB							.29	16	.27	.32	14	.63	.29	39	.51
12.A(5) MANUFACTURING OVERHEAD							.40	15	.42	.30	10	.52	.20	41	.45
12.A(6) OTHER							.36	25	.76	.66	16	1.25	.66	41	1.05
12.A(7) G B A							.93	41	.67	.60	34	.59	.67	79	.32

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12.A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)	5.26	41	.65	4.66	55	1.16	5.30	66	.96
12.B RISK	.55	22	.66	.74	24	.75	.73	42	.99
12.C CAPITAL EMPLOYED	.71	39	.67	.76	32	.59	.76	76	.69
12.D PRODUCTIVITY	.80	0	.80	.80	0	.80	.80	0	.80
12.E INDEPENDENT DEVELOPMENT	.85	1	.85	.85	1	.85	.85	1	.85
12.F OTHER	.02	4	.05	.02	5	.07	.01	4	.03

TOTAL PROFIT/SUBCOST (SUM OF ABOVE)	6.59	61	1.20	6.57	35	1.34	6.61	66	1.12
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TOTAL PROFIT/SUBCOST (ITEM 12.B(7)12.C)	6.66	73	1.00	6.70	77	1.63	6.99	136	1.60
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ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM ZERO ENTRIES FOR THE FISCAL YEAR IN THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

APPENDIX D

**MEASUREMENT BASE
AVERAGE SUMMARY**

TABLE D1. MEASUREMENT BASE (MATERIAL)

MEASUREMENT BASE (8000,000) AVERAGE SUMMARY		INITIAL		ARMY		MATERIAL						
SELECTED FACTORS:	TYPE OF ACTION(S)	DEPARTMENT(S)	C.G. CATEGORY	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
12.A(1)	MATERIALS			17.73	57	35.29	37.71	55	96.71	54.76	76	110.07
12.A(2)	ENGINEERING DIRECT LABOUR			3.12	42	7.39	2.96	39	6.75	3.61	64	3.93
	ENGINEERING OVERHEAD			3.03	30	7.14	2.00	36	5.55	4.22	59	7.34
12.A(3)	MANUFACTURING DIRECT LAB			3.97	51	6.94	10.36	49	19.00	6.64	65	13.73
	MANUFACTURING OVERHEAD			3.95	51	6.91	10.77	49	19.00	12.40	66	19.00
12.A(4)	OTHER			1.75	16	7.45	6.26	20	20.50	7.22	36	30.37
12.A(5)	G & A			5.03	50	10.11	6.17	55	17.72	7.50	79	10.06
12.A(7) CONTRACTION TOTAL EFFORT (SUM UP ABOVE)				41.57	59	66.71	88.97	56	101.50	60.58	79	106.72
12.B	RISK			40.66	53	69.16	67.57	54	101.75	74.99	74	106.96
12.C	CAPITAL EMPLOYED			4.05	56	6.40	6.06	52	26.65	4.55	71	7.71
12.D	PRODUCTIVITY			.00	6	.00	.11	1	.79	.00	0	.00
12.E	IMPLEMENT DEVELOPMENT			5.66	3	32.61	19.26	3	127.76	2.01	1	17.77
12.F	UTHER			.79	7	3.52	2.00	7	9.95	1.61	11	6.96
TOTAL COST UNOBJECTIVE (ITEM 11.A)				60.67	93	65.29	63.62	67	150.07	78.70	110	196.53

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-ZERO ENTRIES FOR THE FISCAL YEAR IN THE LEFT. ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE D2. MEASUREMENT BASE (RES & DEV)

MEASUREMENT BASE (8000,000) AVERAGE SUMMARY		INITIAL		ARMY		RESDEV				
TYPE OF ACTION(S)	DEPARTMENT(S)	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
1499 PROFIT FACTOR		12.00	27	32.21	9.29	25	7.21	07.03	42	607.90
12.A11) MATERIALS		0.02	27	17.35	3.53	24	5.33	19.23	34	84.33
12.A12) ENGINEERING DIRECT LABOR		0.75	27	0.71	3.50	26	3.07	23.29	32	13.00
12.A13) ENGINEERING OVERHEAD		2.76	12	7.50	.43	10	.76	3.11	23	12.45
12.A14) MANUFACTURING DIRECT LAB		3.04	12	0.50	.98	10	4.08	3.49	23	23.72
12.A15) MANUFACTURING OVERHEAD		1.97	17	4.70	1.04	11	4.20	3.89	47	23.03
12.A16) OTHER		7.00	27	15.00	2.04	24	3.04	13.20	51	53.77
12.A17) COMBINATION TOTAL EFFORT (SUM OF ABOVE)		44.26	27	70.90	10.80	25	22.80	120.87	32	477.10
12.B) RISK		39.15	19	80.42	11.01	10	20.49	107.07	23	478.07
12.C) CAPITAL EMPLOYED		3.46	26	7.11	1.40	24	1.50	10.23	49	41.37
12.D) PRODUCTIVITY		.00	0	.00	.00	0	.00	.00	0	.00
12.E) INDEPENDENT DEVELOPMENT		.00	0	.00	.30	1	1.00	.17	1	1.44
12.F) OTHER		.00	0	.00	.05	2	.10	1.10	1	0.45
TOTAL COST UNJECTIVE (ITEM 13.A)		32.12	49	61.99	14.92	35	10.12	94.97	60	300.00

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM- ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT. ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A17) FOR THE APPROPRIATE FISCAL YEAR.

MEASUREMENT MADE (\$000,000) AVERAGE SUMMARY

SELECTED FACTORS: INITIAL

DEPARTMENT(S) ARMY SERVICES

D.O. CATEGORY

1499 PROGRAM FACTOR	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
12.A(1) MATERIALS	3.05	15	5.79	11.75	6	15.24	6.73	14	2.13
12.A(2) ENGINEERING DIRECT LABOR	2.96	19	2.04	16.33	6	17.93	5.17	20	0.08
12.A(2) ENGINEERING OVERHEAD	2.10	19	2.03	12.97	6	19.44	5.98	20	0.09
12.A(3) MANUFACTURING DIRECT LAB	1.29	11	3.04	1.59	2	3.02	2.40	10	0.29
12.A(3) MANUFACTURING OVERHEAD	1.05	10	1.54	2.06	2	4.45	4.59	10	0.00
12.A(4) OTHER	3.17	15	3.06	30.74	6	60.01	7.93	15	27.01
12.A(5) 0 0 A	1.47	20	1.45	3.90	6	4.92	3.29	22	4.53

12.A(7) COMBINATION TOTAL EFFORT (SUM OF ABOVE) 10.17 21 13.36 07.17 0 130.45 30.05 22 40.09

12.B MISC	15.00	16	14.96	05.40	7	139.45	20.00	16	27.22
12.C CAPITAL EMPLOYED	.00	17	.00	1.51	4	3.00	3.07	20	0.02
12.D PRODUCTIVITY	.00	0	.00	.00	0	.00	.00	0	.00
12.E IMPROVEMENT DEVELOPMENT	.00	1	2.19	.00	0	.00	.00	0	.00
12.F OTHER	.20	3	.06	.19	1	.51	.00	0	.00

TOTAL COST SUBJECTIVE (ITEM 11.A) 24.90 37 45.02 30.01 24 07.33 41.29 43 60.54

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM- 2400 ENTRIES FOR THE FISCAL YEAR TO THE LEFT. ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

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ARMY PROCUREMENT RESEARCH OFFICE FORT LEE VA
POLICY AND PRACTICE TRENDS IN WEIGHTED GUIDELINES.(U)

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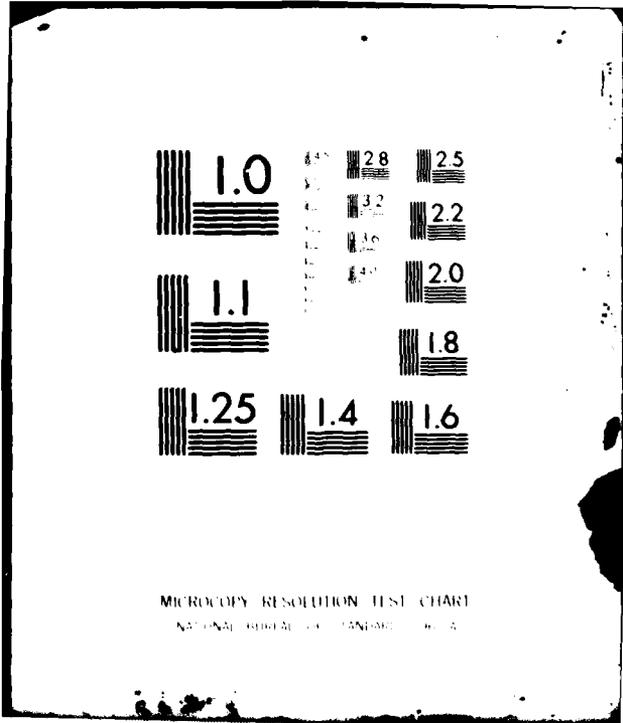
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TABLE D4. MEASUREMENT BASE (PRICE)

MEASUREMENT BASE (\$900,000) AVERAGE SUMMARY		FFP		FPI		FPR				
SELECTED FACTORS:	CONTRACT TYPE(S)	FFP	FPI(S)	FPI	FPR					
TYPE OF ACTION(S)		INITIAL								
DEPARTMENT(S)		ARMY								
1499 PROFIT FACTOR		FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
12.A(1) MATERIALS		10.75	63	10.06	37.40	51	97.43	50.22	69	121.07
12.A(2) ENGINEERING DIRECT LABOR		5.60	49	7.02	4.51	54	10.00	3.04	59	5.15
12.A(3) ENGINEERING OVERHEAD		3.08	45	7.35	4.30	53	10.00	3.04	54	0.51
12.A(4) UTMEN		4.12	50	6.93	10.30	47	20.00	0.06	59	10.57
12.A(5) 6 & 8 A		2.30	25	7.19	15.00	47	31.52	12.00	50	41.24
		5.42	64	11.09	12.40	25	40.05	0.57	59	50.37
					8.41	55	17.96	7.15	73	10.79

12.A(7) CONTRACTOR TOTAL EFFORT		44.41	66	74.57	97.07	54	100.75	70.55	75	196.05
(SUM OF ABOVE)										

12.B RISK		44.41	66	74.57	97.07	54	100.75	70.55	73	196.05
12.C CAPITAL EMPLOYED		4.13	62	7.10	0.12	48	27.31	4.30	64	7.00
12.D PRODUCTIVITY		.00	0	.00	.11	1	.00	.00	0	.00
12.E INDEPENDENT DEVELOPMENT		3.06	3	30.06	10.00	3	100.05	4.10	1	10.47
12.F UTMEN		.60	6	3.34	2.74	7	10.12	1.00	8	7.15

TOTAL COST SUBJECTIVE		43.63	100	72.06	66.04	87	154.46	77.30	103	200.00
(ITEM 11.A)										

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT. ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE D5. MEASUREMENT BASE (COST)

MEASUREMENT BASE (\$300,000) AVERAGE SUMMARY		CPAF		CPFF		CPIF			
SELECTED FACTORS:		INITIAL		INITIAL		INITIAL			
CONTRACT TYPE(S)		ARMY		ARMY		ARMY			
TYPE OF ACTION(S)		ARMY		ARMY		ARMY			
DEPARTMENT(S)		ARMY		ARMY		ARMY			
1499 PROFIT FACTOR	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1976	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
12.A(1) MATERIALS	5.10	36	7.22	0.02	31	22.90	34.94	93	104.15
12.A(2) ENGINEERING DIRECT LABUR	0.33	39	10.11	3.17	33	3.05	14.03	77	36.50
12.A(2) ENGINEERING OVERHEAD	1.09	39	0.02	3.31	33	0.27	10.05	77	59.01
12.A(3) MANUFACTURING DIRECT LAB	1.50	16	0.29	1.30	14	3.94	2.90	34	19.03
12.A(3) MANUFACTURING OVERHEAD	1.02	15	2.24	1.00	14	0.03	0.74	41	21.10
12.A(4) OTHER	1.01	25	3.93	.96	10	1.70	7.33	41	20.02
12.A(5) G & A	3.93	41	10.92	2.73	34	0.30	10.02	79	43.74
.....									
12.A(7) CONTRACTOR TOTAL EFFORT	25.77	41	45.09	23.32	35	40.00	94.97	60	307.96
.....									
12.D RISK	19.00	22	47.13	10.93	24	00.05	02.59	42	300.00
12.C CAPITAL EMPLOYED	1.01	39	3.50	1.02	32	2.30	7.00	76	33.00
12.U PRODUCTIVITY	.00	0	.00	.00	0	.00	.00	0	.00
12.E INDEPENDENT DEVELOPMENT	.25	1	1.29	.27	1	1.00	.11	1	.94
12.F OTHER	.14	4	.56	.12	3	.03	1.00	4	0.90
.....									
TOTAL COST OBJECTIVE	23.23	73	36.76	10.29	77	29.10	77.90	136	314.07
.....									
(ITEM 11.A)									

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
 ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

APPENDIX E

**MEASUREMENT BASE/
SUBCOST (%) AVERAGE**

TABLE E1. MEASUREMENT BASE/SUBCOST (MATERIAL)

MEASUREMENT BASE/SUBCOST (S) AVERAGE SUMMARY		SELECTED FACTORS:		INITIAL		ARMY		MATERIAL		
DEPARTMENT(S)	U.S. CATEGORY	FISCAL 1977	NUM	STANDARD DEVIATION	FISCAL 1978	NUM	STANDARD DEVIATION	FISCAL 1979	NUM	STANDARD DEVIATION
1899	PROFIT FACTOR									
12.A(1)	MATERIALS	36.62	57	20.16	57.19	53	48.83	35.07	76	18.70
12.A(2)	ENGINEERING DIRECT LABOR	7.03	42	9.40	4.98	39	7.61	6.50	66	4.36
	ENGINEERING OVERHEAD	7.90	30	11.57	5.44	36	9.00	9.35	59	10.74
12.A(3)	MANUFACTURING DIRECT LAB	19.65	31	7.41	11.09	49	7.04	9.48	65	6.11
	MANUFACTURING OVERHEAD	17.04	51	15.08	17.56	49	11.57	13.58	66	10.09
12.A(4)	OTHER	3.03	18	6.23	5.87	26	12.00	6.00	36	13.01
12.A(5)	B & A	13.06	58	5.01	11.48	55	5.19	12.35	74	6.74
12.A(7) CONTRACTION TOTAL EFFORT		100.00	59	.00	100.00	56	.00	100.00	74	.00
(SUM OF ABOVE)										
12.9	RISK	69.63	53	56.22	94.06	53	42.54	93.07	74	49.29
12.C	CAPITAL EMPLOYED	13.54	58	16.05	6.32	54	7.27	4.03	71	6.39
12.D	PRODUCTIVITY	.00	0	.00	.10	1	.71	.00	0	.00
12.E	INDEPENDENT DEVELOPMENT	5.00	3	21.97	5.36	3	22.54	1.27	1	11.16
12.F	OTHER	1.19	7	3.36	1.12	7	3.00	1.28	11	3.47

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT. ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE E2. MEASUREMENT BASE/SUBCOST (RES & DEV)

MEASUREMENT BASE/SUBCOST (2) AVERAGE SUMMARY SELECTED FACTORS	INITIAL TYPE OF ACTION(3)	DEPARTMENT(4)	ARMY	SERVICES	1977		1978		1979		STANDARD DEVIATION	
					FISCAL	STANDARD	FISCAL	STANDARD	FISCAL	STANDARD	NUM	NUM
1.99 PROFIT FACTUM					19.22	20.35	24.59	24.59	12.16	12.16	14	14
12.A(1) MATERIALS					17.01	17.04	16.39	16.39	22.00	22.00	20	20
12.A(2) ENGINEERING DIRECT LABOR					13.37	12.82	20.09	15.74	24.00	24.00	20	20
12.A(3) ENGINEERING OVERHEAD					7.10	7.73	2.26	4.93	6.36	6.36	10	10
12.A(4) MANUFACTURING DIRECT LAB					7.85	10.95	3.01	5.39	6.22	6.22	14	14
12.A(5) MANUFACTURING OVERHEAD					21.26	25.09	21.57	25.72	13.06	13.06	15	15
12.A(6) OTHER					11.50	6.08	7.07	5.03	10.58	10.58	22	22
12.A(7) G O A												
12.A(17) CONTINUATION TOTAL EFFORT					100.00	100.00	100.00	100.00	100.00	100.00	22	22
12.B RISK					76.19	42.59	67.50	33.07	72.73	72.73	10	10
12.C CAPITAL EMPLOYED					7.93	9.26	2.52	4.01	9.13	9.13	20	20
12.D PRODUCTIVITY					.00	.00	.00	.00	.00	.00	0	0
12.E IMPROVEMENT DEVELOPMENT					0.76	21.00	.00	.00	.00	.00	0	0
12.F OTHER					.00	1.27	.75	1.90	.00	.00	0	0

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM-LENTH ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE E4. MEASUREMENT BASE/SUBCOST (PRICE)

MEASUREMENT BASE/SUBCOST (2) AVERAGE SUMMARY SELECTED FACTORS; CONTRACT TYPE(S)	FFP	FP(E)	FPI	FPH	1977		1978		1979		STANDARD DEVIATION
					FISCAL	STANDARD DEVIATION	FISCAL	STANDARD DEVIATION	FISCAL	STANDARD DEVIATION	
TYPE OF ACTION(S)	INITIAL				NUM		NUM		NUM		
USPANTMENT(S)	ARMY										
199 PROFIT FACTOR											
12.A(1) MATERIALS					63	29.66	51	19.99	69	19.47	
12.A(2) ENGINEERING DIRECT LABOR					69	9.48	38	7.09	59	11.28	
ENGINEERING OVERHEAD					45	10.55	35	9.17	54	11.75	
12.A(3) MANUFACTURING DIRECT LAB					56	6.61	47	6.31	59	6.96	
MANUFACTURING OVERHEAD					23	13.21	47	12.95	54	11.40	
12.A(4) OTHER					23	16.86	45	13.55	34	14.97	
12.A(5) C & A					54	5.95	53	5.67	73	5.41	

12.A(7) CONTINUATION TOTAL EFFORT (SUM OF ABOVE)					66	.99	54	.89	73	.98	

12.C RISK					64	.89	54	.89	73	.89	
12.C CAPITAL EMPLOYED					62	17.65	48	7.39	64	6.38	
12.D PRODUCTIVITY					6	.99	3	.72	0	.99	
12.E INDEPENDENT DEVELOPMENT					3	20.05	3	22.91	1	11.02	
12.F OTHER					6	5.13	7	3.84	8	3.45	

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NON-ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

TABLE E5. MEASUREMENT BASE/SUBCOST (COST)

MEASUREMENT BASE/SUBCOST (3) AVERAGE SUMMARY		CPAF		CPFF		CPIF		INITIAL		ARMY			
SELECTED FACTORS:	CONTRACT TYPE(S)												
TYPE OF ACTION(S)		FISCAL 1977		STANDARD DEVIATION		FISCAL 1978		STANDARD DEVIATION		FISCAL 1979		STANDARD DEVIATION	
DEPARTMENT(S)		NUM		NUM		NUM		NUM		NUM		NUM	
1999 PROFIT FACTOR		1977		STANDARD DEVIATION		1978		STANDARD DEVIATION		1979		NUM	
12.A(1) MATERIALS		22.26	36	10.39		26.49	51	24.48		19.55	63	17.74	
12.A(2) ENGINEERING DIRECT LABOR		24.55	39	12.26		18.04	53	12.15		22.80	77	11.57	
ENGINEERING OVERHEAD		22.86	59	12.05		21.50	53	14.77		25.26	77	12.74	
12.A(3) MANUFACTURING DIRECT LAB		3.80	16	7.50		4.16	14	6.14		5.75	39	6.15	
MANUFACTURING OVERHEAD		5.50	15	7.50		5.33	14	9.51		4.91	41	7.45	
12.A(4) OTHER		5.80	45	12.13		6.97	10	15.48		7.11	41	14.56	
12.A(5) b 6 A		13.55	41	6.75		12.52	54	5.54		12.22	79	4.52	
12.A(7) CONTRACTOR TOTAL EFFORT (SUM OF ABOVE)		100.00	41	.00		100.00	55	.00		100.00	60	.00	
12.B WISK		53.66	22	49.87		68.57	24	46.62		52.50	42	49.94	
12.C CAPITAL EMPLOYED		9.14	29	6.37		9.80	32	6.88		10.08	76	6.89	
12.D PRODUCTIVITY		.80	0	.00		.80	0	.00		.00	0	.00	
12.E INDEPENDENT DEVELOPMENT		2.44	1	15.45		2.66	1	16.88		1.25	1	11.11	
12.F OTHER		.45	4	1.37		.56	5	1.83		.51	4	1.37	

ENTRIES UNDER NUM ABOVE INDICATE NUMBER OF NUM- ZERO ENTRIES FOR THE FISCAL YEAR TO THE LEFT.
 ALL AVERAGES ABOVE WERE COMPUTED USING THE NUMBER IN 12.A(7) FOR THE APPROPRIATE FISCAL YEAR.

APPENDIX F

COST, PROFIT, PRICE AVERAGES

BY

CONTRACT TYPE

TABLE F1. TOTAL PROFIT (\$000,000) BY CONTRACT TYPE

FY 79 TYPE	<u>CONTRACTOR PROPOSED</u>			<u>GOVERNMENT OBJECTIVE</u>			<u>NEGOTIATED</u>		
	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>
FFP	5.04	124	9.80	3.69	124	7.25	4.07	124	7.87
FP(E)	19.11	12	48.93	12.66	12	31.54	15.23	12	39.77
FPI	16.90	50	29.91	10.90	50	18.61	13.05	50	20.50
FPR									
CPAF	4.33	13	10.53	3.90	13	9.99	3.88	13	9.93
CPFF	2.28	174	3.68	1.65	174	3.02	1.85	174	3.08
CPIF	15.09	60	58.21	9.90	60	36.30	10.35	60	39.11
COST	5.50	247	29.46	3.77	247	18.55	4.02	247	19.91
PRICE	9.14	186	22.20	6.21	186	14.33	7.19	186	16.62
ALL	7.06	433	26.65	4.82	433	16.91	5.38	433	18.63

TABLE F2. TOTAL PRICE (\$000,000) BY CONTRACT TYPE

FY 79	<u>CONTRACTOR PROPOSED</u>				<u>GOVERNMENT OBJECTIVE</u>				<u>NEGOTIATED</u>				
	<u>TYPE</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>
	FFP	40.49	124	75.98	34.68	124	65.78	36.43	124	66.64			
	FP(E)	205.10	12	540.15	165.89	12	431.9	184.64	12	486.78			
	FPI	161.27	50	292.42	124.53	50	223.46	136.87	50	240.46			
	FPR												
	CPAF	136.43	13	299.06	126.36	13	283.54	126.14	13	281.59			
	CPFF	28.94	174	57.29	26.56	174	55.27	27.20	174	55.68			
	CPIF	172.27	60	649.51	137.22	60	483.76	135.99	60	476.72			
	COST	69.41	247	336.83	58.69	247	256.32	58.84	247	252.89			
	PRICE	83.58	186	222.42	67.30	186	174.81	72.99	186	191.27			
	ALL	75.50	433	293.29	62.39	433	224.99	64.92	433	228.57			



TABLE F3. PERCENT PROFIT BY CONTRACT TYPE

FY 79	<u>CONTRACTOR PROPOSED</u>				<u>GOVERNMENT OBJECTIVE</u>				<u>NEGOTIATED</u>			
	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>		<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>		<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	
FFP	13.94	124	3.73		11.49	124	2.10		11.98	124	2.39	
FP(E)	11.05	12	1.75		9.78	12	1.31		9.28	12	1.79	
FPI	12.35	50	1.76		9.93	50	1.38		11.17	50	1.11	
FPR				←				NONE				→
CPAF	3.38	13	1.52		2.91	13	1.76		2.90	13	1.77	
CPFF	9.17	174	1.63		7.00	174	1.28		7.85	174	1.12	
CPIF	9.25	60	1.37		7.48	60	1.16		7.92	60	1.06	
COST	8.88	247	2.04		6.90	247	1.60		7.61	247	1.60	
PRICE	13.33	186	3.34		10.96	186	2.03		11.59	186	2.20	
ALL	8.65	433	2.70		8.65	433	2.70		9.32	433	2.73	

TABLE F4. TOTAL COSTS (\$000,000) BY CONTRACT TYPE

FY 79	<u>CONTRACTOR PROPOSED</u>				<u>GOVERNMENT OBJECTIVE</u>				<u>NEGOTIATED</u>				
	<u>TYPE</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>	<u>AVG</u>	<u>NUM</u>	<u>STD DEV</u>
	FFP	35.45	124	66.27	30.99	124	58.56	32.36	124	58.82			
	FP(E)	185.99	12	491.23	153.22	12	400.37	169.41	12	447.01			
	FPI	144.36	50	264.61	113.63	50	204.99	123.86	50	220.38			
	FPR												
	CPAF	132.10	13	288.60	122.46	13	273.62	122.26	13	271.74			
	CPFF	26.66	174	53.78	24.91	174	52.30	25.36	174	52.69			
	CPIF	157.19	60	591.33	127.32	60	447.51	125.65	60	437.71			
	COST	63.91	247	307.73	54.92	247	238.04	54.82	247	233.35			
	PRICE	74.44	186	201.12	61.09	186	160.68	65.80	186	174.92			
	ALL	58.44	433	267.25	57.57	433	208.38	59.53	433	210.32			

APPENDIX G

**GRAPHS OF DIFFERENCES BETWEEN
FORECASTED AND ACTUAL VALUES**

```

.999 I > 45.00 I .0010
.999 I 40.00 I
.999 I 35.00 I
.999 I 30.00 I
.999 I 25.00 I
.997 I 20.00 I .0020
.992 I 15.00 I .0050
.965 I 10.00 I .0270
.752 I 5.00 I
.356 I .00 I
.202 I -5.00 I .1541
.124 I -10.00 I .0760
.074 I -15.00 I .0500
.042 I -20.00 I .0320
.029 I -25.00 I .0130
.023 I -30.00 I .0060
.016 I -35.00 I .0050
.015 I -40.00 I .0030
.013 I -45.00 I .0020
.000 I < -45.00 I .0130

```

```

THE MEAN IS 1
THE MEDIAN IS 2
LARGEST VALUE IS 3
NUMBER OF RECORDS IN ABOVE DATA IS 999
GRAPH OF PERCENT DIFFERENCE BETWEEN FORECASTED AND ACTUAL NEGOTIATED COST
FORECAST EQUATION: Y=AX+B
WHERE Y=ESTIMATED NEGOTIATED COST
AS 1.31595, AND B= .97628, N=999
FOR FY 77 THROUGH FY 79. SELECTED FACTORS SHOWN BELOW
DEPARTMENT(1) ARMY
X=CONTRACTOR COST
THE STAN DEV IS 4 5 6 7 8 9 10
THE MODE IS 2.500
SMALL VALUE IS -101.473

```

FIGURE G1. DIFFERENCES BETWEEN FORECASTED AND ACTUAL NEGOTIATED COST


```

.999 I > 45.00 I .0010
.999 I 40.00 I
.999 I 35.00 I
.999 I 30.00 I
.999 I 25.00 I
.999 I 20.00 I .0010
.999 I 15.00 I .0000
.999 I 10.00 I .0350
.733 I 5.00 I .2232
.362 I .00 I .5703
.199 I -5.00 I .1631
.123 I -10.00 I .0760
.070 I -15.00 I .0450
.049 I -20.00 I .0290
.032 I -25.00 I .0170
.025 I -30.00 I .0070
.017 I -35.00 I .0000
.010 I -40.00 I .0010
.012 I -45.00 I .0000
.000 I < -45.00 I .0120

```

```

THE MEAN IS 2.584 THE STAN DEV IS 11.642
THE MEDIAN IS 2.473 THE MODE IS 2.500
LARGEST VALUE IS 69.022 SMALL VALUE IS -100.005
NUMBER OF RECORDS IN ABOVE DATA IS 999
GRAPH OF PERCENT DIFFERENCE BETWEEN FORECASTED AND ACTUAL NEGOTIATED PRICE
FUNCTION EQUATION: Y=0.0000
WHERE Y=ESTIMATED NEGOTIATED PRICE X=CONTRACTOR COST
AS 3.41500,4NO 05 .97733 N 004860 0 .99592
FOR FY 77 THROUGH FY 79. SELECTED FACTORS SHOWN BELOW:
DEPARTMENT(1) ARMY

```

FIGURE G3. DIFFERENCES BETWEEN FORECASTED AND ACTUAL NEGOTIATED PRICE


```

.000 I > 45.00 [#####] .0120
.067 I 40.00 [#####] .0210
.021 I 35.00 [#####] .0460
.066 I 30.00 [#####] .0550
.776 I 25.00 [#####] .0000
.712 I 20.00 [#####] .0640
.660 I 15.00 [#####] .0520
.600 I 10.00 [#####] .0600
.555 I 5.00 [#####] .0450
.469 I .00 [#####] .0450
.304 I -5.00 [#####] .0450
.299 I -10.00 [#####] .0450
.264 I -15.00 [#####] .0550
.201 I -20.00 [#####] .0450
.166 I -25.00 [#####] .0350
.140 I -30.00 [#####] .0200
.119 I -35.00 [#####] .0410
.112 I -40.00 [###] .0070
.095 I -45.00 [#####] .0170
.000 I < -45.00 [#####] .0930

```

```

THE MEAN IS -13.070 THE STD DEV IS 119.409
THE MEDIAN IS 0.233 THE MOD IS -07.500
LARGEST VALUE IS 80.000 SMALL VALUE IS -2753.206
NUMBER OF RECORDS IN ABOVE DATA = 999
GRAPH OF PERCENT DIFFERENCE BETWEEN FORECASTED AND ACTUAL NEGOTIATED PROFIT
FORECAST EQUATION: Y=1.000X + .97005 M SQUARED = .93030
WHERE Y=ESTIMATED NEGOTIATED PROFIT
X=ACTUAL NEGOTIATED PROFIT
FOR FY 77 THROUGH FY 79. SELECTED FACTORS SHOWN BELOW:
DEPARTMENT(1) ARMY

```

FIGURE G5. DIFFERENCES BETWEEN FORECASTED AND ACTUAL NEGOTIATED PROFIT

.005	I	>	45.00		.0150
.005	I		40.00		.0200
.007	I		35.00		.0300
.050	I		30.00		.0370
.700	I		25.00		.0400
.710	I		20.00		.0700
.650	I		15.00		.0600
.500	I		10.00		.0660
.500	I		5.00		.0750
.403	I		.00		.0650
.300	I		-5.00		.0550
.310	I		-10.00		.0700
.202	I		-15.00		.0400
.222	I		-20.00		.0400
.190	I		-25.00		.0200
.100	I		-30.00		.0300
.151	I		-35.00		.0170
.123	I		-40.00		.0100
.120	I		-45.00		.0130
.000	I	<	-45.00		.1201

THE MEAN IS -10.351 THE STAN DEV IS 73.377
 THE MEDIAN IS 9.500 THE MODE IS -67.500
 LARGEST VALUE IS 70.000 SMALL VALUE IS -1030.379
 NUMBER OF RECORDS IN ABOVE DATA = 999
 GRAPH OF PERCENT DIFFERENCE BETWEEN FORECASTED AND ACTUAL PROFIT OBJECTIVE
 FORECAST EQUATIONS YEAR=88
 WHERE ESTIMATED PROFIT OBJECTIVE XSCONTRACTOR COST
 AS .10155*ANO BS .97100 *M SQUARED = .92395
 FOR FY 77 THROUGH FY 79. SELECTED FACTORS SHOWN BELOW
 DEPARTMENT(1) ARMY

FIGURE 66. DIFFERENCES BETWEEN FORECASTED AND ACTUAL PROFIT OBJECTIVE

STUDY TEAM COMPOSITION

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13. ABSTRACT
The Weighted Guidelines (WGL) method is an approach to assure the proper usage of various factors in deriving profit objectives for negotiated contracts. The DAR states that each contractor proposal is to be evaluated with respect to its individual merits and a profit objective is to be determined with consideration given to the various profit items. Yet it has been observed that the entire range of allowed profit is not being used. The policy to derive objectively negotiated profit is being carried out when viewed from the averages of the weights alone. However, the intent of the policy is not being adhered to in view of the narrow range of weights being used despite the allowance in the policy for a much broader allowable range. Consequently, negotiated cost, price, and profit become a predictable function of the contractor's proposed cost. Despite the presence of several factors which are to be considered in determining percent profit, the actual percent profit depends upon whether the contract is a cost-type or price-type contract. The analysis also indicates that a target percent profit exists which tends to prevent the intent of the policy from being realized. Finally, there appears to be a threshold of percent profit for cost-type contracts which causes proposals which exceed it to be scrutinized more than others.

Security Classification

KEY WORDS

LINE A

LINE B

LINE C

ROLE

WT

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WT

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Negotiated Contracts

Profit Objective

Negotiated Cost