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AN ANALYSIS OF THE RELATIONSHIP OF OVERAGE TIME SPANS
IN THE CONTRACT-CLOSURE PROCESS AND OPPORTUNITY COSTS

Frederick N. Galante, et al

Air Force Institute of Technology
Wright-Patterson Air Force Base, Ohio

August 1975

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Frederick N. Galante, Captain, USAF
Ronald J. Peterson, Captain, USAF
Rick J. Williams, 1st Lt, USAF

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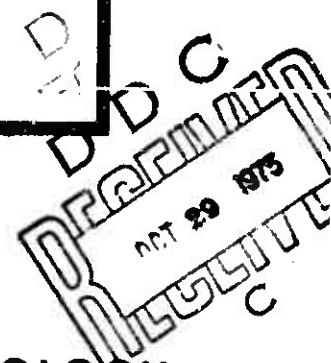
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Department of Defense acceptance of goods or services purchased by contract does not signify the completion of a contract. The completion of the required administrative tasks subsequent to acceptance is called the contract-closure process. Delays in completing the contract-closure process are creating opportunity costs. The opportunity cost of an extended contract-closure process is the alternative that is sacrificed to maintain the present contract-closure process. The earlier the closure process is completed, the earlier excess funds can be released to other government projects. The study analyzed the overage contracts on the Contract Status Report issued by Air Force Contract Management Division. Factors that increase the overage time span were identified. In addition, the opportunity cost (over \$2.8 million) associated with these factors was calculated. The conclusions of this study indicate: (1) overage time span increases with face value, (2) overage time span decreases with an increase in unliquidated obligation, (3) a few overage reason codes have a significant impact on the overage time span of contracts, and (4) a majority of the opportunity cost incurred is attributable to a small number of overage reason codes.

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AN ANALYSIS OF THE RELATIONSHIP OF OVERAGE
TIME SPANS IN THE CONTRACT-CLOSURE
PROCESS AND OPPORTUNITY COSTS

A Thesis

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University

In Partial Fulfillment of the Requirements for the
Degree of Master of Science in Logistics Management

By

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fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

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TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS.	111
LIST OF TABLES	v11
LIST OF FIGURES.	v111
 Chapter	
I. INTRODUCTION	1
Problem Statement.	1
Overview	1
Definitions.	3
Background	8
Regulations.	8
Policy statement	10
Interviews	12
Justification.	12
Scope.	14
Research Hypotheses.	15
Research Questions	16
II. RESEARCH METHODOLOGY	17
Universe Description	17
Population of Interest	18
Sampling Plan.	20
Justification for Sampling Plan.	21
Data Collection.	22
Description of data collection	22

Chapter	Page
Design of Study.	24
Summary of multiple regression analysis. .	24
Operational definition and categorization of the variables	24
The research models.	28
Validation of regression model	29
Coding of research hypotheses and research questions	31
Hypothesis testing	31
III. DATA ANALYSIS.	38
Overview	38
Disposition of Data Base	38
General Regression Models.	41
Sample Application of the Regression Model .	45
Coefficient Validation Matrix.	46
Category A Contracts	47
Effect of Category Type on Overage Time Span.	50
Analysis of Opportunity Cost	50
Summary of Assumptions	53
Summary of Limitations	54
IV. STATISTICAL AND PRACTICAL SIGNIFICANCE OF RESEARCH HYPOTHESES.	56
Introduction	56
Research Hypotheses Related to Face Value. .	57
Research Hypotheses Related to Unliquidated Obligation.	58
Statistical and Practical Significance of Reason Code Research Hypotheses.	59

	vi
Chapter	Page
Support of Category B Reason Code Research Hypotheses.	60
Support of Category C Reason Code Research Hypotheses.	63
Statistical Test of Research Hypotheses Not Supported.	68
Non-Support of Category B Reason Code Research Hypotheses.	69
Non-Support of Category C Reason Code Research Hypotheses.	69
Summary of Research Hypotheses	70
Practical Significance of Research Questions 1 - B; C	72
V. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY	73
Overview	73
Conclusions.	73
Corollary Conclusions.	79
Recommended Future Studies	81
Summary.	82
APPENDICES	
A. FORMS RELATED TO CONTRACT-CLOSURE.	83
B. LIST OF PERSONNEL INTERVIEWED.	88
C. SUMMARY OF OPPORTUNITY COST.	91
D. SUMMARY OF CATEGORY C CONTRACTS WITH NO OVERAGE TIME SPAN.	95
E. SUMMARY OF CONTRACTS DELETED FROM THE DATA BASE.	97
SELECTED BIBLIOGRAPHY.	99
A. REFERENCES CITED	100
B. RELATED SOURCES.	102

LIST OF TABLES

Table	Page
1. Close-Out Time Standards.	7
2. Summary of the Opinions of Contract-Closure Personnel Interviewed	13
3. Summary Table of Variables.	25
4. Reason for Delayed Closing of Contract File . . .	27
5. Summarization of Statistical Tests.	35
6. Summary of Hypothesis Testing	36
7. Summary of Contracts Included in Study.	40
8. Data Base Total Dollar Values	40
9. Regression Coefficient Values	43
10. Coefficient Validation Matrix--Category B	48
11. Coefficient Validation Matrix--Category C	49
12. Opportunity Cost--Category B.	51
13. Summary of Category C Opportunity Cost.	51
14. Total Opportunity Cost Incurred	52
15. Non-Support of Category B Reason Code Research Hypotheses	69
16. Non-Support of Category C Reason Code Research Hypotheses	70
17. Summary of Research Hypotheses Test Results . . .	71
18. Practical Significance of Research Question 1 - B; C.	72

LIST OF FIGURES

Figure	Page
1. Diagram of Contract-Closure Process.	5
2. Total Procurement Dollars by Overage Category Type.	15
3. DOD Organization for Contract Administration . .	18
4. AFPRO Organization and Location.	19
5. Quarterly Cycle of Contract Status Report Data Collection.	23

CHAPTER I

INTRODUCTION

Problem Statement

Department of Defense acceptance of goods or services purchased by contract does not signify the completion of a contract. To satisfy administrative requirements many tasks must be accomplished after acceptance of the goods or services (16:16). The completion of these tasks is called the contract-closure process. Each task is to be completed within specified time limits (16). If completion of any task exceeds the time limits, the entire contract-closure process may be delayed. This delay is creating an opportunity cost (4:4). Specifically, the opportunity cost of an extended contract-closure process is the alternative that is sacrificed to maintain the closure process. The alternative, in this case, is the use of funds obligated to the contract. The more rapid the closure process is completed the earlier excess funds can be released to other government projects (14:1). This study will identify those areas which are major factors in causing contract-closure delays.

Overview

Procurement of goods and services for the Department of Defense is a complex process. The viability of the Armed

Forces of the United States is directly linked to the efficient operation of the procurement process (5:37). The major vehicle for accomplishing this procurement is the contract (15:Sec.1). According to the Air Force School of Systems and Logistics Continuing Education Contract Administration text (10:III-9), there are three general phases involved in the procurement process. The three phases are: (1) the Pre-award Phase, which consists of defining requirements, soliciting bids, and choosing the contractor; (2) the Award Phase, in which the actual award and signing of the contract occurs; and (3) the Post-award Phase, which involves the performance of the contract, acceptance of the goods or services, and finally the use and disposal of the goods by the government.

The dollar value of a contract can vary from a few hundred dollars for the purchase of spare parts, to well over a billion dollars for the acquisition of a major weapons system. Irrespective of dollar value, the efficient administration of government contracts and their funds is necessary (3:33-42).

In many respects, the success of any procurement action hinges in large measure on how the contract is administered during its performance. In terms of multiplicity of functions involved and the time span of performance, contract administration has come to represent a major field in procurement and a vital element in the delivery of defense materials [5:10].

One segment of contract administration that has been neglected is the contract-closure process. As stated by Mr. Donald O'Neill, Administrative Contracting Officer, Acquisition Management Information System, Systems Program

Office, at Wright-Patterson AFB, Ohio: "The emphasis in the past has been on getting funds on the contracts and the contracts out the door; there was little attention paid to the closure process [6]."

Definitions

To provide a common frame of reference, the terms used in this study are defined as follows:

A. Date Physically Completed--The date the government accepts the goods or services that have been contracted. This acceptance may occur at the buying office, plant, or any other location designated by the contract. This date symbolizes the beginning of the contract-closure process (8).

B. Contract-Closure Process--The administrative requirements that must be accomplished between the date of physical completion and the date the contract file is retired to the Federal Records Center. Depending on the category of contract, some or all of the following tasks will be accomplished (16):

- (1) Disposition of classified material
- (2) Final patent report
- (3) Final royalty report
- (4) Value engineering changes complete
- (5) Plant clearance complete
- (6) Settlement of interim or disallowed costs
- (7) Settlement of subcontracts by the prime contractor
- (8) Prior year overhead rates completed

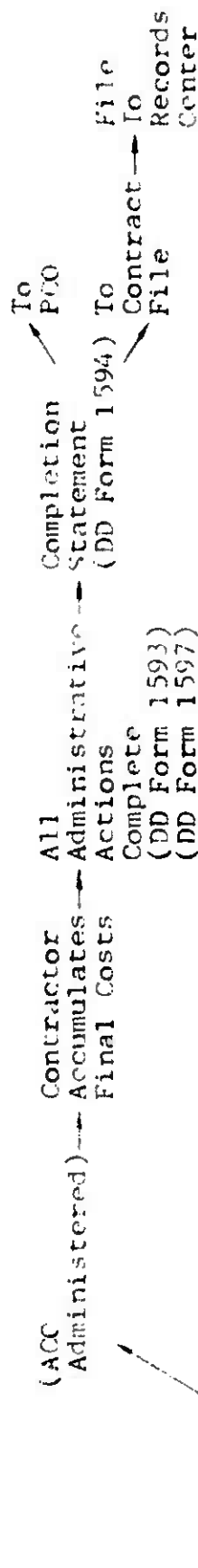
- (9) Contractor's closing statement
- (10) Contract audit complete
- (11) Final voucher paid
- (12) Final removal of excess funds
- (13) Issuance of contract completion statement
- (14) Retirement of contract file to Federal Records Center

Figure 1 illustrates the contract-closure process, reference page 5.

C. Contractor Final Negotiated Overhead Rates--The expenses that cannot be assigned directly to any one cost objective. These expenses usually are not calculated until approximately one year after they are incurred. For cost-type contracts, these expenses are negotiated for the specific year they are incurred and incorporated into the contract with a supplemental agreement (10:VII-31).

D. Cost-Reimbursement Contract--This type of contract is used when the cost of the work cannot be adequately described to guarantee performance. The contractor is reimbursed for the costs he experiences in the performance of the contract. Certain types of cost-reimbursement contracts provide for an incentive fee or fixed-fee that is paid to the contractor (10:III-1).

E. Procuring Contracting Officer (PCO)--The official at the buying organization who negotiates and signs the contract for the needed goods and services. He has the authority to act as the government's representative in contractual matters (15:Sec.4,71-77).



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Complete
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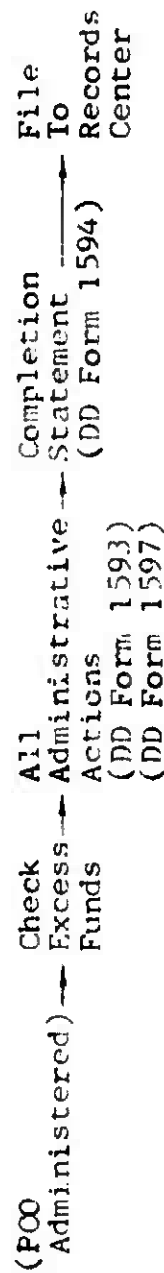


Figure 1

Diagram of Contract-Closure Process

Source: U.S. Department of the Air Force. Contract Administration. School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB, Ohio, August, 1974.

F. Administrative Contracting Officer (ACO)--The official placed in charge of administering a contract by request of the PCO. It is the ACO's duty to monitor the contract and assure proper compliance with all contractual requirements. The authority of the ACO closely parallels that of the PCO but is not as extensive (15:Sec.4,71-77).

G. Unliquidated Obligation (ULO)--Funds that have been obligated to a government contract, but have not been paid to the contractor (10:VIII).

H. Date of Contract Completion/Original Milestone Closing Date--The date the PCO signs the DD Form 1594 Contract Completion Statement (Appendix A). If the Acquisition Management Information System (AMIS) is being used, it is the date the PCO places a letter in the contract file signifying receipt of the AMIS PK9 (a computer format identifier for the DD Form 1594). This is the last administrative procedure before the contract file is retired to the Federal Records Center (16:15).

I. Fixed-Price Contract--This type of contract usually stipulates a firm price. Under the fixed-price type contract, the contractor guarantees the performance of the contract. Under some circumstances, portions of the price are left open and adjusted later (10:III-1).

J. Contract Status Report (CSR)--A management report used by the Air Force Contract Management Division, Kirtland Air Force Base, New Mexico, to record contract administration

progress. Information from this report formulates the data base for this study (8).

K. Revised Milestone Closing Date--The date the contract-closure process is rescheduled to be completed according to the estimate of the assigned Administrative Contracting Officer (8).

L. Overage Contract--A contract that has not been closed within the standard time spans delimited in the Armed Services Procurement Supplement 2-305. Overage contracts are divided into three categories, A, B, and C. Table 1 presents the standard time spans for closing contracts and defines Categories A, B, and C (16).

Table 1
Close-Out Time Standards

Category	Contract Type	Calendar Months AFTER the Month in which Physically Completed
A	Fixed Price Small Purchase Orders (\$2,500 and under)	3
B	Firm Fixed Price (Excluding A above)	6
C	All Other	20

Source: Armed Services Procurement Supplement 2-305, Washington, D.C.: U.S. Government Printing Office, 1 July 1974.

M. Contract Face Value--The total value of the contract. This amount includes the original contract amount plus any amounts that have been added to the original contract by supplemental agreements.

N. Opportunity Cost--The alternative that must be sacrificed to maintain the status quo. In this study opportunity cost refers to the time value of the unliquidated obligation that remains on a contract due to delays in the contract-closure process. Opportunity cost is a function of unliquidated obligation, overage time span, and the discount rate defined in Department of Defense Directive 7041.3 (17).

Background

The body of knowledge available on the subject of contract-closure is limited. The information available can be divided into three general categories: (1) regulations, (2) policy statements, and (3) interviews with personnel in the contract-closure field.

Regulations. The procurement policy of the Department of Defense (DOD) is defined in the Armed Services Procurement Act of 1947.

The Procurement Act provides for two methods of procurement, formal advertising and negotiation. Formal advertising must be used except when advertising falls within certain categories of the Act. These categories or exceptions as they are referred to, provide the authority to negotiate. The Act also prescribes certain procedures for formal advertising and sets forth specific restrictions and qualifications as to type of contracts that may be used [10:1-2].

The Procurement Act is limited to general procurement policy. Therefore, under the direction of the Assistant Secretary of Defense (Installations and Logistics), the Armed Service Procurement Regulation (ASPR) is issued pursuant to DOD Directive 4105.30 dated March 11, 1959. This regulation provides for:

. . . carrying out the provisions of the Procurement Act and to establish policies for procurement areas not covered by it. In addition, the ASPR provides direction and guidance for complying with pertinent statutes and executive orders. It covers policies, practices, and procedures for both formal advertising and negotiation. It also covers other procurement topics such as pricing, types of contracts, contract clauses, and contract cost principles [10:1-3].

The specific section within ASPR that deals with contract-closure is Supplement 2. A review of ASPR Supplement 2 revealed a lack of detailed contract-closure procedures. The supplement deals with results, but does not mention the procedures to be followed to obtain these results. The majority of the close-out procedure is left to the discretion of the ACO. Of the twenty-four sections, appendices, and supplements to ASPR (over 3,000 pages) only five pages are written on contract-closure (16:15-19).

ASPR Supplement 2 formulates the basis of contract-closure policy from which administrative procedures were developed. Apparently the volume of procurement within the last ten years indicated a need for an automated contract administrative system. These needs were to be satisfied by the creation of the Military Standard Contract Administration Procedures (MILSCAP)-DOD 4105.63-M.

[MILSCAP] . . . prescribes standard procedures for use in exchanging procurement/contract administration data between purchasing offices (including inventory and program managers) and field contract administration offices, e.g., DCASRs [Defense Contract Administration Service Regions] and plant cognizance representatives. This information system is designed for high speed digital data transmission and automatic data processing systems. Procedures shown . . . were developed by agreement between representatives from all Military Departments, Defense Supply Agency, and the CASD (Comptroller) [18:i].

After completion of the manual, MILSCAP was not implemented. However, a systems program office (SPO) located at Wright-Patterson Air Force Base is revising MILSCAP for use by the Air Force Systems Command under the acronym AMIS (Acquisition Management Information System). The system will specify a step-by-step contract-closure process. Phase I of AMIS is currently operational and incorporates aspects of the MILSCAP contract-closure procedures. Phase II of AMIS will be a real time contract management program that will track all events specified in the closure process. Phase II is not expected to be implemented until December 1976.

Policy statement. No Department of Defense regulations concerning contract-closure procedures have been issued since Supplement 2 of the ASPR was revised in 1970. However, inter-staff letters and staff studies reveal that a policy statement may be issued in the near future. The possibility is illustrated in the recommendations from inter-staff letters that have been issued as recently as September 1974 (11; 13).

A Memorandum to the Chairman of the ASPR Committee, dated 4 December 1973, entitled, "The Minority Position Regarding Use of an Overhead Milestone Form," suggests that untimely contract-closure is creating a

drain on Contract Administration Services resources [and] . . . warrants Committee action to either (1) provide the ACO with a tool to coordinate and expedite overhead settlement and contract close out as proposed by DCAS, or (2) extend the twenty month standard in ASPR S2-305. . . . DCAS believes that the latter alternative would not only evade the real issue of delayed overhead settlement . . . but would also fail to alleviate the problem . . . of completed but unclosed contracts no matter what the standard in ASPR S2-305 [19:Tab F-2].

A letter from the Director of Procurement Support at Air Force Systems Command (AFSC), dated 29 August 1974, to the Air Force Contract Management Division at Kirtland Air Force Base, New Mexico, further reinforces the idea that there is a current effort being made to issue a policy statement in the area of timely contract-closure. This letter requests data to ". . . satisfy an analysis of three areas related to physically completed contracts [12:1]." The three areas being analyzed by AFSC are: (1) the time periods for closing physically completed contracts, (2) the reasons physically completed contracts are not closed within the ASPR standard times, and (3) the amount of excess funds after final payment as opposed to the amount of excess funds on contract upon physical completion (12:1).

Another letter from the DCS/Comptroller, AFSC, dated 13 September 1974, indicates interest in the contract-closure area is being generated by finance as well as procurement

personnel. This letter addresses, once again, the amount of unliquidated obligation (ULO) remaining on a contract after the date of physical completion and recommends procedures to monitor funds more closely (11:2).

Interviews. There is a lack of written literature concerning the contract-closure process; therefore, a majority of the knowledge gained concerning this process has been obtained through interviews with personnel who are working in the contract-closure field (Appendix B). These officials have related the past history of this process, stated the current status of contract-closure in their particular organizations, discussed their personal opinions concerning problem areas within contract-closure, and offered suggestions for correction of these problems.

Although the personnel interviewed represented many diverse organizational backgrounds, the opinions expressed concerning the contract-closure process were similar. The opinions of the personnel interviewed (Appendix B) are summarized in Table 2, page 13.

Justification

There is a need for a full scale review of contract-closure procedures. Top level management at the Air Force Systems Command, Defense Supply Agency, and Air Force Contract Management Division realize that the present contract-closure procedures are inefficient (12; 13; 19). In an inter-staff letter by Brigadier General Hans Driessnack,

DCS/Comptroller/AFSC, emphasis was placed on the efficient closure of contracts to prevent the problems related to funds stagnation (11:2). After interviewing 15 individuals (Appendix B) performing in a wide range of functions related to the contract-closure process, it was noted that their opinions were based on suspected causes. None of the personnel interviewed could reference a detailed study that supported their suspicions. The consensus of the individuals interviewed indicates that there is not enough emphasis placed on contract-closure and, as a result, the present contract-closure procedures are inefficient.

Table 2

Summary of the Opinions of Contract-Closure
Personnel Interviewed

-
1. High level management is concerned with the contract-closure process.
 2. Procedures concerning this process should be more clearly defined.
 3. Clear, concise procedures would eliminate the administrative costs presently being incurred because of ambiguous, limited ASPR procedures.
 4. The negotiation of contractor final overhead rates is preventing the timely closure of contracts.
-

No literature has been located that indicates there has been a study accomplished which supports the opinions repeatedly expressed during the personal interviews. The material available concerning contract-closure consists of

policy letters, Supplement 2 of ASPR, summaries of ASPR presented in contract administration textbooks, staff letters concerned with topics related to contract-closure, and the Military Standard Contract Administration Procedures (MILSCAP) manual. Apparently, no one has made an effort to synthesize the existing policies and procedures, nor has anyone tried to scientifically analyze the suspected problem areas of contract-closure.

Scope

"Contract closing requirements vary with the dollar value, complexity, and type of contract [10:xx-1]." This study includes Category A, B, and C Contracts being administered by the Air Force Contract Management Division (AFCMD). Category A, B, and C Contracts are defined in Supplement 2 of ASPR (reference page 7, Table 1). Figure 2, page 15, illustrates the distribution of total procurement dollars by overage category type.

To limit the population and provide for a more realistic sample, this study addresses only overage contracts contained in the physically complete section of the Contract Status Report (CSR). This report is discussed in Chapter II under Data Collection. The data base developed from the CSR will be used to test the validity of the research hypotheses.

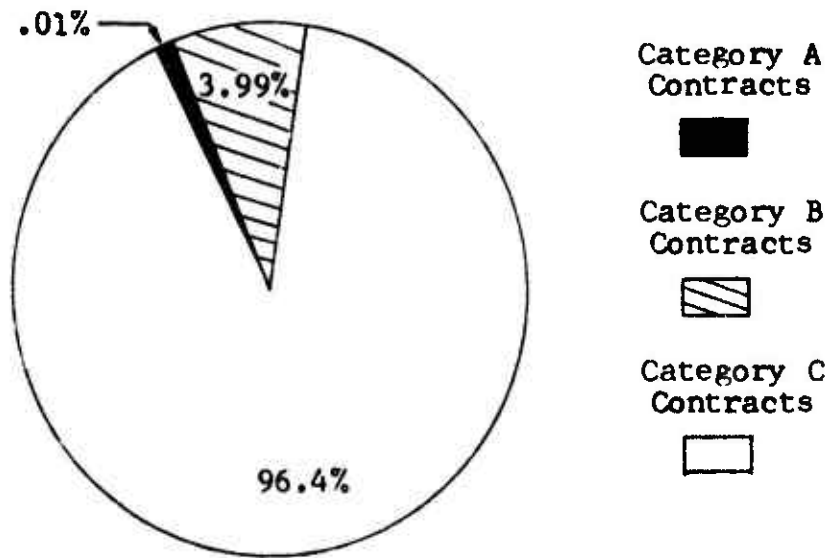


Figure 2

Total Procurement Dollars by Overage Category Type

Source: Contract Status Report. Kirtland AFB, New Mexico, 28 February 1975.

Research Hypotheses

There are three basic research hypotheses in this study. The coding of these research hypotheses is discussed in Chapter II, Research Methodology, page 31. The research hypotheses to be tested are:

Research Hypotheses 1 - AX_{23} ; BX_{23} ; CX_{23}

There is a relationship between the time span a contract is overage and the face value of the contract.

Research Hypotheses 2 - AX_{24} ; BX_{24} ; CX_{24}

There is a relationship between the time span a contract is overage and the unliquidated obligation.

Research Hypotheses 3 - AX₁₋₂₂! BX₁₋₂₂! CX₁₋₂₂

There is a relationship between the time span a contract is overage and the reason codes for overage.

Research Questions

In addition to the research hypotheses, one research question will be tested for each overage category.

Research Questions 1 - A; B; C

Is a disproportionate amount of opportunity cost caused by a small number of overage reason codes?

CHAPTER II

RESEARCH METHODOLOGY

Universe Description

The universe for this study consisted of all overage contracts being administered by Department of Defense (DOD) components: the Defense Contract Administration Service (DCAS), the Army, the Navy, and the Air Force. Overage contracts are defined as those contracts that have not been closed within the standard time spans specified in the Armed Services Procurement Supplement 2-305. Overage contracts are divided into three categories, A, B, and C. This study addressed all three categories. Table 1, page 7, presents the standard time spans for closing contracts and defines Categories A, B, and C. The DOD organization for contract administration is presented in Figure 3, page 18.

Since the DOD administers contracts world-wide, in a broad spectrum of dollar values, the universe includes DOD contracts of all dollar values and geographical locations. The fact that all DOD components administer their contracts according to the Armed Services Procurement Regulation provides homogeneity in respect to the administration of the contracts in the universe.

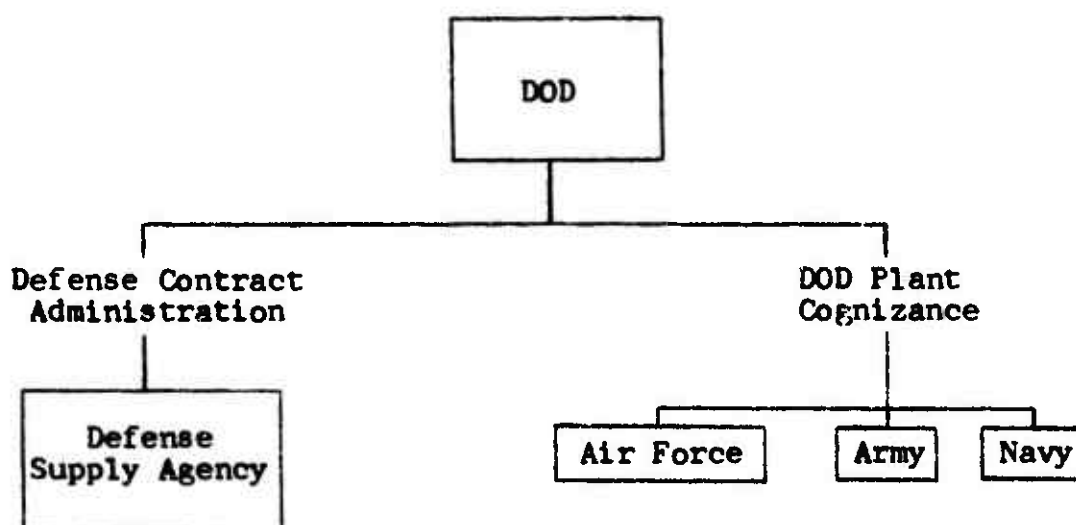


Figure 3

DOD Organization for Contract Administration

Source: U.S. Department of the Air Force. "AFCMD Information Pamphlet." Kirtland AFB, New Mexico, August, 1972.

Population of Interest

The population consists of all contracts administered by the Air Force Contract Management Division (AFCMD), Kirtland Air Force Base, New Mexico. AFCMD

. . . performs contract management functions at those contractor plants assigned to the Air Force for plant cognizance and ensures the government's interest while executing assigned and delegated contract administration functions [9].

An analysis of Figure 4, page 19, illustrates the organizational structure and location of the Air Force plant cognizance offices, also termed Air Force Plant Representative Offices (AFPRO's), which report to the Commander of AFCMD. The contracts administered by the Air Force Plant Representative Offices, located in the United States, vary from

AFQMD
Commander

Aerojet General Sacramento, California	AVCO Wilmington, Massachusetts	Boeing Seattle, Washington	Martin Denver, Colorado	General Dynamics Fort Worth, Texas	Lockheed Marietta, Georgia
General Electric Valley Forge, Pennsylvania	GMC Allison, Indiana	Fairchild Farmingdale, New York	General Electric Evendale, Ohio	Northrop Los Angeles, California	Lockheed Sunnyvale, California
McDonnell Douglas Huntington Beach, California	McDonnell Douglas St. Louis, Missouri		Hughes Culver City, California	Rockwell International B-1 Los Angeles, California	
Tniokol Brigham City, Utah	Rockwell International Rocketdyne Los Angeles, California		UTC Sunnyvale, California	Rockwell International Electronics Los Angeles, California	

Figure 4

AFPRO Organization and Location

Source: U.S. Department of the Air Force. "AFQMD Information Pamphlet." Kirtland AFB, New Mexico, August, 1972.

small dollar amounts to major weapon systems acquisitions in the millions of dollars. The contracts in the population were not limited by dollar value, administering AFPRO, or contract type.

Sampling Plan

Since all overage contracts are categorized as A, B, or C Contracts, these categories formed predetermined division points. The division points provided three distinct sections for analysis within the Contract Status Report (CSR). The following procedure was used to extract the raw data and code it in the proper format for keypunching the computer cards; the cards then formulated the data base for this study:

1. All overage contracts were identified and labeled as A, B, or C category contracts.
2. All the contracts in each category were assigned an integer number so that the contracts could be uniquely identified.
3. After each contract was labeled, the following information was extracted:
 - a. Type of Contract
 - b. Original Milestone Closing Date
 - c. Revised Milestone Closing Date
 - d. Reason for Delay
 - e. Total Contract Amount
 - f. Unliquidated Amount

4. Upon completion of the data extraction, the worksheets were checked against the CSR to insure accuracy of extraction.

5. The data on the worksheets was keypunched and checked for errors to insure accuracy.

6. The BMD02R Stepwise Regression Program was used to calculate a mean and standard deviation for the face value of the A, B, and C category contracts. (A discussion of the BMD02R Regression Program is presented on page 29.)

Justification for Sampling Plan

The sample analyzed was a sample of convenience taken from the 28 February 1975 Contract Status Report (CSR) issued by AFCMD. This specific Contract Status Report was chosen because it represented the most accurate, complete, and current collection of data available concerning the subject population. Since the sample was not random, a description of the sample is provided to allow the reader to (1) visualize the population which the sample represents, and (2) determine for himself if the group to which they had hoped to generalize these results differed in any significant manner from the sample (2:327). The sample had the following characteristics:

1. The sample consisted of all overage contracts administered by the Air Force Contract Management Division as of 28 February 1975.

2. The contracts were not limited by administering AFPRO or contract type.

3. The sample consisted of 888 contracts: 797 Category C contracts, 79 Category B contracts, and 12 Category A contracts. (There were 1359 overage contracts listed on the CSR; Appendix E summarizes the reasons 471 contracts were deleted from the sample.)

4. To be retained in the sample, the following information items had to be included on the contract.

- a. Original Milestone Closing Date
- b. Revised Milestone Closing Date
- c. Overage Reason Code
- d. Total Contract Amount

This sample was taken from the population of contracts managed by the Air Force Contract Management Division. Therefore, inferences will be limited to those contracts that are defined in the population of interest. Even though all Department of Defense components administer their contracts according to the Armed Service Procurement Regulation, internal procedures for contract-closure within the Department of Defense components differ. This study does not make inferences to the universe.

Data Collection

Description of data collection. The Administrative Contracting Officer (AOO) assigned to a specific contract is required to submit data updating the Contract Status Report (CSR) on a quarterly basis. A review of Figure 5, page 23, illustrates the CSR quarterly updating cycle.

The cycle begins when the ACO updates the CSR by annotating on his copy of the CSR any changes that have occurred in the status of the contract. The ACO has 35 days to make these changes and return the updated CSR to Air Force Contract Management Division (AFCMD) Headquarters. Upon receipt of the CSR, the Acquisition Management Information System section, AFCMD/AQ, extracts the changes annotated by the ACO. This data is then keypunched and forwarded to the Production Control Branch, AFCMD/ACDC, where the data is entered into the computer data base. The updated Contract Status Report is then published and distributed to the Air Force Plant Representative Offices and the cycle repeats itself (8).

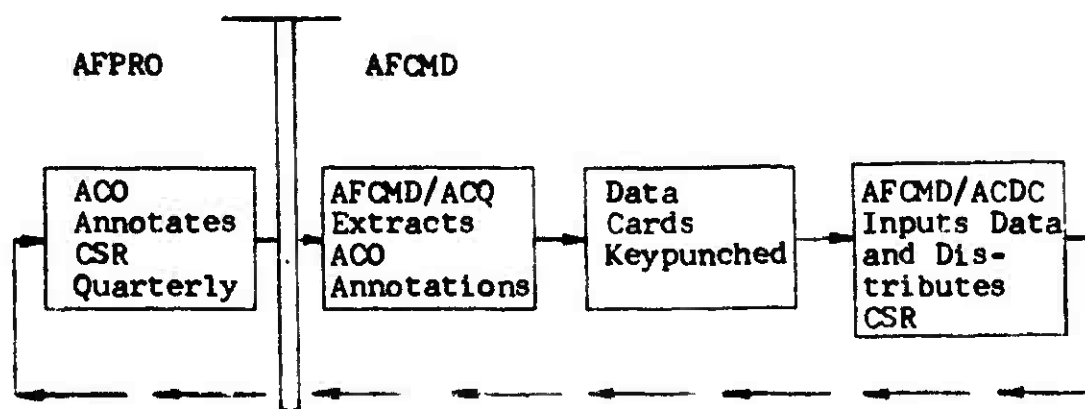


Figure 5

Quarterly Cycle of Contract Status Report Data Collection

All data used in this study was extracted from the 28 February 1975 Contract Status Report (CSR) generated at Air Force Contract Management Division (AFCMD), Kirtland

Air Force Base, New Mexico. The CSR is the primary management tool used by AFCMD to track and record contract close-out progress.

Design of Study

Summary of multiple regression analysis. The general form of the multiple regression model is:

$$Y = B_0 + B_1X_1 + B_2X_2 + \dots + B_{11}X_{11}$$

where Y is the estimated value of the dependent variable and X denotes values for the independent variables. The B_0 term is a constant. The value of B_0 is dependent upon the nature of the variables which are included in the model. The terms $B_1, B_2, B_3, \dots, B_{11}$ are the net regression coefficients; each coefficient measures the change per unit of the dependent variable for one unit change in the independent variable (20:304). An operational definition of Y, the dependent variable, and all X values, the independent variables, follows.

Operational definition and categorization of the variables. A tabular summarization of variables, definitions, classification level, range of values, data level, and units of input are presented in Table 3, page 25. The following expanded definitions are presented:

1. Dependent Variables-- Y_1, Y_2 , and Y_3 correspond to the time span between the Original Milestone Closing Date and the Revised Milestone Closing Date for A, B, and C

Table 3
Summary Table of Variables

Variable	Classification Level	Range of Values	Data Level	Units of Input
Y_1, Y_2, Y_3	Continuous	0-Infinity	Interval	Years*
	Time span between original ASPR closing date and revised estimated closing date for A, B, and C contracts, respectively			
X_{23}	Continuous	0-Infinity	Interval	Dollars**
	Face Value of Contract			
X_{24}	Continuous	0-Infinity	Interval	Dollars**
	Unliquidated Obligation			
$X_1 - X_{22}$	Discrete	0 or 1	Nominal	N/A
	Reason Codes			

*All times were rounded to the nearest tenth of a year. Those values with the thousandth digit greater than 5 were rounded up; otherwise, they were rounded down.

**All dollar values were rounded to whole dollars. Those values which were greater than \$.50 were rounded up. Those values less than or equal to \$.50 were rounded down.

contracts, respectively. The Original Milestone Closing Date is the original date the contract-closure process was to be completed in accordance with Armed Services Procurement Supplement 2-305. The Revised Milestone Closing Date is the date the contract-closure process is rescheduled for completion according to the estimate of the responsible Administrative Contracting Officer. The time span was used to calculate the opportunity costs referred to in Research Question One.

2. Independent Variables--The independent variables range from X_1 to X_{24} . X_2 was the Total Contract Amount appearing on the Contract Status Report, measured in dollars. The face value varied from a few dollars to over one billion dollars. X_{24} was the dollar amount appearing on the CSR under the category Unliquidated Amount. The Unliquidated Amount is the amount of money that has been obligated to the contract, but has not been expended. The unliquidated amount is measured in dollars and ranged from zero to approximately two million dollars. The independent variables X_1 through X_{22} are termed dummy variables since the only values they can assume are zero and one. The use of dummy variables is further explained by the fact that each overage contract could be coded for only one reason for going overage. The reasons a contract goes overage are coded on the CSR in an alpha-character form under the category heading "Reason for Delay." These reason codes and their associated variable name (X_1 to X_{22}) are contained in Table 4, page 27.

Table 4

Reason for Delayed Closing of Contract File

Definition: The factors which contribute to the delay in closing the contract file within the time period established as the norm.

Code	Independent Variable	Explanation
A	(X ₁)	Contractor has not submitted final invoice/voucher.
B	(X ₂)	Final acceptance not received.
C	(X ₃)	Contractor has not submitted patent/royalty report.
D	(X ₄)	Patent/royalty clearance required.
E	(X ₅)	Contractor has not submitted proposal for final price redetermination.
F	(X ₆)	Supplemental agreement covering final price redetermination required.
G	(X ₇)	Settlement of subcontracts pending.
H	(X ₈)	Final audits in process.
J	(X ₉)	Disallowed cost pending.
K	(X ₁₀)	Final audit of Government property pending.
L	(X ₁₁)	Independent Research and Development rates pending.
M	(X ₁₂)	Negotiation of overhead rates pending.
N	(X ₁₃)	Additional funds requested but not yet received.
P	(X ₁₄)	Reconciliation with Paying Office and contractor being accomplished.
Q	(X ₁₅)	Armed Services Board of Contract Appeals case.
R	(X ₁₆)	Public Law 85-804 case.

Table 4 (continued)

Code	Independent Variable	Explanation
S	(X ₁₇)	Litigation/investigation pending.
T	(X ₁₈)	Termination in process.
U	(X ₁₉)	Warranty clause action pending.
V	(X ₂₀)	Disposition of Government property pending.
W	(X ₂₁)	Contract modification pending.
X	(X ₂₂)	Contract release and assignment pending.

Source: U.S. Department of Defense. Military Standard Contract Administration Procedures. DOD 4105.63-M, Office of the Assistant Secretary of Defense, Washington, D.C., December, 1971.

The research models. Using the variables given in Table 3, page 25, the research models are written as:

$$Y_1 = B_0 + P_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \dots + B_{24}X_{24}$$

$$Y_2 = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \dots + B_{24}X_{24}$$

$$Y_3 = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \dots + B_{24}X_{24}$$

The independent variables, X₁ through X₂₂, X₂₃, and X₂₄, were chosen because of the belief that there was a relationship between these variables and the time a contract remained open past the Original Milestone Closing Date. When calculated, the regression coefficients provide a better

understanding of the various relationships that increase the time a contract is overage.

The BMD02R Stepwise Regression Program was used to perform the regression on the models. This program, one of a series developed by the UCLA Biomedical Computer Facility, was accessed through the CREATE Computer Library at the School of Systems and Logistics, Wright-Patterson AFB, Ohio. The BMD02R program:

. . . computes a sequence of multiple linear regression equations in a stepwise manner. At each step, one independent variable is added to the regression equation . . . and the effects of the added variable are analyzed and tabulated [1,233].

Validation of regression model. The first statistical test performed was a test of significance on each research model regression equation. The test involved an F-test computed at the .95 percent significance level. The F-test is a test of the statistical significance of the coefficient of determination, R^2 , of the regression model. The BMD02R Regression Program calculated a coefficient of determination for each of the three regression models, Y_1 , Y_2 , and Y_3 . The corresponding coefficients of determination were labeled $(R_1)^2$, $(R_2)^2$, and $(R_3)^2$, respectively. The coefficients of determination are a measure of the explained variation of the independent variables about the regression line divided by the total variation. The closer this value approaches unity, the more reliable the regression model is as a description of the relationship between the dependent and independent variables of the model. The F-test

was established in the following manner with H_0 as the null hypothesis, and H_1 as the alternate:

$$H_0: B_1 = B_2 = B_3 = B_4, \dots, B_{24} = 0$$

$$H_1: B_1 \neq 0; B_2 \neq 0; \dots, B_{24} \neq 0 \text{ (or any combination)}$$

Using the previously chosen significance level of .95, a comparison of sample and critical F values for each model was accomplished. The critical F value for each model was taken from the .95 F distribution found in the CRC Standard Math Tables (7:621-626). The value from the math tables is presented as F_{crit} and is located by entering the table with both the upper and lower degrees of freedom, v_{upper} and v_{lower} . The value of v_{upper} is equal to the number of parameters in the regression equation minus one. The value of v_{lower} is equal to the sample size minus the number of parameters in the regression equation.

The sample value for F was calculated by the regression program. The general form of the calculation of F_{sample} was:

$$F_{sample} = \frac{(R^2)/(p-1)}{(1 - R^2)/(n - p)}$$

where n = sample size and p = number of parameters in the research model. The F_{crit} was then compared with the F_{sample} . If the sample value of F was less than F_{crit} the null hypothesis could not be rejected; if the value of F_{sample} was greater than F_{crit} the null hypothesis could be rejected and

a statistical relationship between the independent and dependent variable could be supported.

Coding of research hypotheses and research questions. Research Hypotheses One, Two, and Three will be tested for Overage Categories A, B, and C. In addition, twenty-two variables are to be tested in conjunction with Research Hypothesis Three. To preclude the necessity of stating a different research hypothesis for each combination of category type and variable (a total of sixty-six research hypotheses), each of the three research hypotheses will be coded to incorporate all possible combinations. The code will specify the overage category and variable that are associated with that particular research hypothesis. The format for the research hypotheses follows: Research Hypothesis 1, 2, or 3; Overage Category A, B, or C; Variable to be tested ($X_1 - X_{24}$). The following example is provided for clarification: Research Hypothesis 3 - CX_{18} . In this instance, Research Hypothesis Three is tested for Overage Category C in relation to variable X_{18} , Termination in Process. Table 4, pages 27 and 28, summarizes the variables, X_1 through X_{27} , and their corresponding explanation.

Hypothesis Testing. Statistical significance of the regression coefficients was directly related to the following research hypotheses:

Research Hypotheses 1 - AX_{23} ; BX_{23} ; CX_{23}

There is a relationship between the time a contract is overage and the face value of the contract. These hypotheses are related to $B_{23}X_{23}$, the product of the face value of the contract multiplied by the net regression coefficient.

Research Hypotheses 2 - AX_{24} , BX_{24} , CX_{24}

There is a relationship between the time a contract is overage and the unliquidated obligation. These hypotheses are related to $B_{24}X_{24}$, the product of the unliquidated obligation multiplied by the net regression coefficient.

Research Hypotheses 3 - AX_{1-22} , BX_{1-22} , CX_{1-22}

There is a relationship between the time a contract is overage and the reason codes for overage. These hypotheses are related to B_1X_1 , B_2X_2 , B_3X_3 , ..., $B_{22}X_{22}$, the products of the overage reason codes multiplied by the appropriate regression coefficients.

The test used to establish statistical significance of the individual regression coefficients was the T-test. The T-test involved a comparison of the critical value of t , t_{crit} , and the sample values of t , t_{samp} . The calculation of the sample t values was accomplished using the sample statistic F_i . The BMD02R program calculated an F term for each of the independent variables in the research model. Those F_i terms were similar to the F_{samp} calculated for each regression model; however, each F_i related only to the independent variable it was associated with.

Example: F_1 would relate to B_1

F_2 would relate to B_2

$F_3, \dots, F_{24}$ would relate to $B_3, \dots, B_{24}$

The statistical test for the regression coefficients for the independent variables was accomplished at the .99 level of significance. This limit was chosen to decrease the probability of incorrectly rejecting the null hypothesis associated with each independent variable. The null and the alternate hypotheses were established in the following manner:

$$H_0: B_i = 0$$

$$H_1: B_i \neq 0$$

(where i represents the values 1 through 24 corresponding to each independent variable). The CRC Standard Math Tables were used to determine the critical T value, T_{crit} (7.617). The value was established using a level of significance of .99 and v_T , the number of degrees of freedom. The value of v_T is equal to the sample size minus the number of parameters in the model or $v_T = (n-p)$. The value of t_{crit} remained constant for all 24 independent variables. The next step was to calculate a T value for each of the 24 net regression coefficients. The form used was:

$$T_i = \sqrt{F_i}$$

(where i represented the values 1 through 24). Similar to the F -test, if the value for T_i was greater than T_{crit} the null hypothesis could be rejected which supported the

relationship between the independent variable X_1 and the dependent variable either Y_1 , Y_2 , or Y_3 . If T_1 was less than T_{crit} the null hypothesis could not be rejected. Table 5, page 35, presents a summarization of statistical tests.

Those t-tests which indicated statistical significance between the dependent and independent variable were reviewed. A decision rule to determine the practical significance of these relationships was: An independent variable would be considered significant if it caused the overage time span, Y , to exceed .33 years. This rule was based on the opinion of an expert in the field of contract-closure, Mr. Donald J. O'Neill, Contracting Officer, Acquisition Management Information System Program Office. This decision rule was used to test the practical significance of the following research hypotheses:

Research Hypotheses 1 - AX_{23} , BX_{23} , CX_{23}

There is a relationship between the time span a contract is overage and the face value of the contract.

Research Hypotheses 2 - AX_{24} , BX_{24} , CX_{24}

There is a relationship between the time span a contract is overage and the unliquidated obligation.

Research Hypotheses 3 - AX_{1-22} , BX_{1-22} , CX_{1-22}

There is a relationship between the time span a contract is overage and the reason codes for overage.

Table 5

Summarization of Statistical Tests

.95 Level of Significance		.99 Level of Significance	
$F_{crit} = F$ value taken from CRC Standard Math Tables	$T_{crit} = T$ value taken from CRC Standard Math Tables		
$H_0: B_1 = B_2 = B_3, \dots, B_{24} = 0$	$H_0: B_i = \emptyset$		(where i represented values 1 through 24)
$H_1: B_1 \neq 0; B_2 \neq 0; \dots, B_{24} \neq 0$	$H_1: B_i \neq \emptyset$		
Degrees of Freedom	Degrees of Freedom		
$v_{upper} = (p - 1)$ $n =$ sample size	$v_T = (n - p)$ $n =$ sample size		
$v_{lower} = (n - p)$ $p =$ number of parameters	$p =$ number of parameters		
$= 25$	$= 25$		
$F_{sample} = \frac{(R^2)/(p - 1)}{(1 - R^2)/(n - p)}$	$t_{sample} = \sqrt{F_i}$ (where i represented values 1 through 24)		
If $F_{sample} > F_{crit}$ reject H_0	If $T_{sample} > T_{crit}$ reject H_0		

Table 6 summarizes the relationship between each research hypothesis, the related variables, the statistical test on the variables, and the decision rule which allowed the variable to support the associated hypothesis. Each research hypothesis was tested for Overage Categories A, B, and C (reference page 31).

Table 6
Summary of Hypothesis Testing

Research Hypothesis and Overage Category	Related Variable	Test of Statistical Significance	Test for Practical Significance
1 - A ₁ B ₁ C	X ₂₃ ; Face Value	$t_{23} > t_{crit}$	If the increase in Y > .33 years for Y ₁ or Y ₂ or Y ₃ the hypothesis was supported (6).
2 - A ₁ B ₁ C	X ₂₄ ; ULO	$t_{24} > t_{crit}$	
3 - A ₁ B ₁ C	X ₁₋₂₂ ; Reason Codes	$t_{1-22} > t_{crit}$	

Research Hypotheses 3 - AX₂₄; BX₂₄; and CX₂₄ were used in consonance with a deterministic equation to calculate opportunity cost to test Research Question One for Overage Categories A, B, and C.

Research Question 1 - A; B; C

A disproportionate amount of Opportunity Cost is created by a small number of the overage reason codes.

The deterministic equation used to calculate opportunity cost is:

$$[(1 + i)^n \times \text{ULO}] - \text{ULO} = \text{Opportunity Cost}$$

where i = 10 percent, the standard DOD discount rate (17)
and n = overage time period.

The opportunity cost was calculated in the following manner:

1. The Unliquidated Amount (ULO), time overage, and the reason code were sorted from the existing decks of key-punched computer cards containing the data for the regression analysis.

2. The opportunity cost was computed using the previously described opportunity cost equation. These costs were then summed by both reason code and contract category.

The decision rule used to test Research Question One is explained in the following manner. Research Question One will be practically significant if: (1) a group of statistically significant reason codes which account for less than fifty percent of the twenty-two overage reason codes is identified, and (2) that group of reason codes is responsible for more than fifty percent of the total opportunity cost for that category of contracts.

CHAPTER III

DATA ANALYSIS

Overview

The data analysis focused on four major areas. The data base is summarized according to the contracts that were included in the study and those contracts that were omitted from the study. Second, a statistical evaluation of the general regression models is accomplished. This section of the chapter also presents a sample application of the regression model. Third, the coefficient validation matrices are presented to explain the statistical significance of the variables that represent overage reason codes. Finally, the opportunity cost associated with these reason codes is calculated.

The assumptions and limitations that constrained this study are also presented in this chapter.

Disposition of Data Base

The research for this study originally involved the analysis of 1359 overage contracts. However, as the study progressed the data base decreased to a total of 888 contracts. A summary of the contracts deleted from the data base is presented in Appendix E. The reasons for deletion fall into three categories:

1. There were 438 contracts deleted from the data base because no overage reason code was annotated on the Contract Status Report.

2. All contracts with face value of more than three standard deviations away from the mean were deleted from the data base. These contracts were omitted to insure that the average face value of contracts used in this study provided a representative measure of central tendency (20:14-17). Nine contracts were deleted from the data base for this reason.

3. Twenty-four contracts were deleted from the data base because no information was available on the length of time these contracts had been overage.

The 33 contracts that were deleted from the data base for reasons two and three, above, generally have a large ULO balance. Management attention to this group of contracts might yield substantial savings.

Table 7, page 40, provides summary data concerning the contracts which were included in this study. The majority of contracts which were included are Category C contracts. Also, the "C" contracts had the largest average ULO and the longest average time overage. Table 8, page 40, is presented to provide the reader with further information concerning the total dollar values involved.

Table 7
Summary of Contracts Included in Study

Summary Statistic	Category Type		
	A	B	C
# in the Category	12	79	797
Mean Face Value	\$ 664.00	\$ 994,361.00	\$ 3,764,672.00
Total Face Value	\$7,968.00	\$78,554,519.00	\$3,000,443,584.00
Mean ULO	\$ 1.00	\$ 10,732.00	\$ 11,455.00
Total ULO	\$ 12.00	\$ 847,865.00	\$ 9,129,674.00
Mean Time Overage	1.04 yr.	1.50 yr.	2.19 yr.

Table 8
Data Base Total Dollar Values

	Included	Deleted	Total
Number of Contracts	888	471	1359
% of Total	65%	35%	100%
Face Value	\$3,079,006,071	\$6,847,709,650	\$9,926,715,721
% of Total	31%	69%	100%
ULO	\$9,997,551	\$9,975,357	\$19,972,908
% of Total	50.1%	49.9%	100%

General Regression Models

Results of the compilation and processing of all relevant data using the BMD02R Regression Program are shown in the output of the following three equations:

Category A

$$Y_1 = B_0 + B_6X_6 + B_{19}X_{19} + B_{20}X_{20} + B_{21}X_{21} \\ + B_{23}X_{23} + B_{24}X_{24}$$

Category B

$$Y_2 = B_0 + B_1X_1 + B_2X_2 + B_4X_4 + B_8X_8 + B_9X_9 \\ + B_{10}X_{10} + B_{12}X_{12} + B_{15}X_{15} + B_{17}X_{17} + B_{18}X_{18} \\ + B_{19}X_{19} + B_{20}X_{20} + B_{21}X_{21} + B_{23}X_{23} + B_{24}X_{24}$$

Category C

$$Y_3 = B_0 + B_1X_1 + B_2X_2 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 \\ + B_8X_8 + B_9X_9 + B_{10}X_{10} + B_{12}X_{12} + B_{13}X_{13} \\ + B_{14}X_{14} + B_{15}X_{15} + B_{17}X_{17} + B_{20}X_{20} + B_{21}X_{21} \\ + B_{22}X_{22} + B_{23}X_{23} + B_{24}X_{24}$$

The equations correspond to the three categories of contracts, respectively. Some of the reason code variables defined for this study are not included in the equations because they were not observed in the original data. The values of each of the "B_i" coefficients may be found in Table 9, pages 43-44, beneath the respective category type. It should be noted that variables X₂₃, Face Value and X₂₄,

Unliquidated Obligation, have been scaled down by factors of \$1,000,000 and \$1,000, respectively. Therefore, in order to use these coefficients to calculate the average time span, it is necessary to divide the Face Value by \$1,000,000 and the ULO by \$1,000, respectively. A sample calculation is presented following Table 9.

One of the important factors of any regression model is the extent to which it explains the variance of the dependent variable, " Y_i ." The measure of the power of this explanation is found in the value R^2 , and its corresponding measure of statistical significance, "F." Values for R^2 , the coefficient of determination, and "F" are presented at the bottom of Table 9 for each category type. A review of these figures indicates that the R^2 term for both category "B" and "C" contracts is low. However, the "F" value for each of these equations exceeds the critical "F" value calculated at the .95 level of significance. This indicates that the total amount of variation explained by the chosen variables was relatively low. However, the statistical significance of these variables is high, and they are important in explaining the closure process.

In the case of the Category A contracts, the R^2 of .9688 and "F" value of 4.39 suggests a strong predictive equation. It should be noted that due to limitations in the data, only 12 contracts were included in the sample. Since 12 contracts are not a representative sample, further reference to Category A contracts will be limited.

Table 9
Regression Coefficient Values

Coefficient	Reason Code	Description	Values		
			Category A	Category B	Category C
B ₀	--	Constant	.72	.58	.88
B ₁	A	Contractor Final Voucher	--	.97	2.97
B ₂	B	Final Acceptance	--	.47	.86
B ₄	D	Patent/Royalty Clearance	--	1.72	.72
B ₅	E	Final Price Redetermination	--	--	.08
B ₆	F	Supplemental Agreement	.01	--	.38
B ₇	G	Subcontract Settlement	--	--	.33
B ₈	H	Final Audit	--	.26	2.51
B ₉	J	Disallowed Cost	--	1.67	.77
B ₁₀	K	Audit Government Property	--	.72	.62
B ₁₂	M	Overhead Rates	--	1.68	.81
B ₁₃	N	Additional Funds Requested	--	--	1.95
B ₁₄	P	Reconciliation w/Finance	--	--	.70
B ₁₅	Q	Armed Services Board of Contract Appeals	--	.64	1.44

Table 9 (continued)

Coefficient	Reason Code	Description	Values		
			Category A	Category B	Category C
B ₁₇	S	Litigation	--	2.25	1.90
B ₁₈	T	Termination	--	2.49	--
B ₁₉	U	Warranty Clause	.29	.46	--
B ₂₀	V	Disposition Government Property	1.85	.68	1.02
B ₂₁	W	Contract Modification	.84	.10	.20
B ₂₂	X	Contract Release	--	--	1.74
B ₂₃	--	Face Value/\$100,000,000	-228.88	.03	.01
B ₂₄	--	ULO/\$1,000	87.71	-.002	-.003
"F" Sample			25.871	2.51	11.53
"F" Critical			4.39	1.83	1.59
R ²			.9688	.3736	.2199

Sample Application of the Regression Model

To facilitate the understanding of the regression models used, the following example is presented. Assume a contract with the following properties has just gone overage:

Contract Type: C
 Overage Reason Code: M (Calculation of Overhead Rates)
 Face Value: \$23,400,000.00
 ULO: \$1,500.00

The Category C model would be chosen, and the above values would be substituted into their respective variable positions. All other variables would be set equal to zero. The resultant general form of the computation would be:

$$Y_3 = B_0 + B_{12}X_{12} + B_{23}X_{23} + B_{24}X_{24}$$

Remembering to scale the Face Value and the ULO by 1,000,000 and 1,000 respectively, and using the coefficient values found on Table 9, pages 43-44, the computational equation is written as:

$$\begin{aligned} Y_3 &= (.88) + (.81)(1) + (.01)(23.4) + (-.003)(1.5) \\ &= 1.9195 \text{ yrs.} \end{aligned}$$

It is possible to infer from this value that, given normal management practices, this contract would remain overage for approximately 1.9 years. This figure is of course subject to many management factors which could either lengthen or shorten the overage period. With this in mind, it seems appropriate to discuss the statistical significance of the individual regression coefficients.

Coefficient Validation Matrix

The matrices illustrated in Tables 10 and 11, pages 48 and 49, present the significant statistical and practical relationships between all the regression coefficients used in the Category B and C regression models. These matrices are valuable when predicting and comparing the overage time span of two Category B or C contracts with equal ULO and face value, but different reasons for being overage. The following explanation will clarify the use of this table.

The reason code at the end of the row and at the top of the column should correspond to the reason codes of the overage contracts for which the comparison is being made. Find the row reason code that corresponds to the reason that is causing one of the overage contracts to remain overage. Scan across that row of the matrix until the column reason code of the other contract is reached. If there is a value at the intersection of the row and column, the number may be interpreted as the time difference that will exist between the closing dates of the two contracts being compared. The sign of the number indicates which contract will close first. A negative sign indicates that the contract annotated with the column reason code will close earlier than the other contract. A positive value indicates that the contract annotated with the column reason code will close later than the other contract. If there is no value at the intersection of the row and the column, no comparison can be made. This does not mean that a time difference does not exist. It

merely indicates that the time difference between the reason codes could not be statistically supported by the observations collected for this study.

The rows of the matrices that are annotated with double stars indicate reason codes that may be holding contracts overage longer than other reason codes observed. It is not possible to state with certainty that these are the reason codes that are keeping overage contracts open. However, the negative signs that consistently appear across the row indicate that a specific reason code does have a tendency to keep a contract open for longer periods of time than other reason codes. A review of Tables 10 and 11, pages 48 and 49, shows that: (1) reason codes D, S, and T tend to cause Category B contracts to be overage longer than the other reason codes, and (2) reason codes A, H, N, Q, S, and X tend to cause Category C contracts to be overage longer than the other reason codes.

Category A Contracts

There were only 12 valid observations concerning the Category A contracts. Further analysis of this category was not accomplished because any inferences made from such a small sample would not be valid. A coefficient validation matrix was not constructed nor were opportunity cost calculations accomplished for Category A contracts. The combination of Category A contracts and Category B contracts into one cell was considered. However, it was decided that this combination would bias the Category B contracts.

Table 10
Coefficient Validation Matrix--Category B**

Column Reason Codes										
	A	B	D	F	K	S	T	U	V	W
A							1.52			
B							2.02			
*D				-1.72						-1.62
F			1.72			2.25	2.49			
K							1.78			
*S				-2.25						-2.15
*T	-1.52	-2.02		-2.49	-1.78			-2.03	-1.81	-2.39
U							2.03			
V							1.81			
W			1.62			2.15	2.39			

* Reason codes having a tendency to increase overage time spans.

** Values in the matrix represent overage time spans.

Table 11
Coefficient Validation Matrix--Category C**

	A	B	D	E	F	H	J	K	M	N	P	Q	S	U	V	X
*A		-2.11	-2.24	-2.89	-2.59		-2.19	-2.35	-2.15		-2.27	-1.52	1.06	-2.97	-1.94	
B 2.11																
D 2.24						2.43				1.88		1.37	1.83			1.67
E 2.89						2.13										
F 2.59																
*H				-2.43	-2.13						-1.81			-2.51		
J 2.19																
K 2.35						1.89							1.28			
M 2.15						1.70						.63	1.09			
*N					-1.88									-1.95		
P 2.27						1.81							1.20			
*Q 1.52				-1.37	-1.06				.63					-1.45		
*S 1.06				-1.83	-1.52			-1.28	-1.09		-1.20			-1.90		
U 2.97						2.51				1.95		1.45	1.90			1.74
V 1.94																
*X				-1.67										-1.74		

*Reason codes having a tendency to increase overage time span.

**Values in the matrix represent overage time spans.

Effect of Category Type on Overage Time Span

To test the effect of contract type on overage time span, a regression analysis was performed on the 888 contracts included in this study. A T-test was performed on the variables that represented contract type. This test indicated that a C Category contract has a tendency to remain overage longer than a B Category contract. For example, if a B Category contract and a C Category contract of equal face value, ULO, and coded with the same overage reason code were compared, the C Category contract would be overage .93 years longer than the B Category contract.

Analysis of Opportunity Cost

Opportunity cost was calculated for each overage reason code for both Category B and Category C contracts. Appendix C presents the ULO, opportunity cost, and the number of observations for each overage reason code in Category B and Category C. This analysis, however, will address only those reason codes in Categories B and C that were discussed on page 47. These were the reason codes in each category that had a tendency to keep contracts overage longer than other reason codes. Table 12, page 51, presents a summary of the opportunity cost that was calculated for the three reason codes identified in Category B.

Reason codes S and T represent six percent of the total ULO and four percent of the total opportunity cost.

Table 12
Opportunity Cost--Category B

Reason Code	Number of Observations	Unliquidated Obligation (Dollars)	Opportunity Cost (Dollars)
D	6	0	0
S	2	4,550	1,409
T	5	49,867	3,288
All Other	66	793,448	111,884
Total	79	847,865	116,581

Six reason codes in Category C were identified as having a tendency to keep contracts overage longer than other reason codes observed. Table 13 summarizes the opportunity cost attributed to these contracts.

Table 13
Summary of Category C Opportunity Cost

Reason Code	Number of Observations	Unliquidated Obligation (Dollars)	Opportunity Cost (Dollars)
A	108	1,098,933	359,322
H	17	606,877	105,215
N	7	281	111
Q	97	1,116,997	181,960
S	102	888,460	244,095
X	2	851,021	278,115
All Other	464	4,567,105	618,188
Total	797	9,129,674	1,787,006

Reason codes A, H, N, Q, S, and X represent fifty percent of the total ULO and sixty-five percent of the total opportunity cost associated with Category C contracts.

Table 14 summarizes all opportunity cost incurred by the overage contracts that were listed in the 28 February 1975 Contract Status Report. This summary is divided into two sections: (1) contracts that are included in the data base for this study, and (2) contracts deleted from the data base due to lack of information. It is important to note that twenty-four C Category contracts, with a ULO totaling \$5,300,594, are not included in this summary because it was not possible to determine how long these contracts had been overage. A negative ULO of \$3,157,074 is included in the \$5,300,594. This figure was included in the calculation because there is an opportunity cost associated with ULO whether the idle funds are in the hands of the government or the contractor. A summary of these contracts is presented in Appendix D.

Table 14
Total Opportunity Cost Incurred

Category Type	Included (Dollars)	Deleted (Dollars)	Total (Dollars)
A	1	139	140
B	116,581	11,238	127,819
C	1,787,006	924,469	2,711,475
All Contracts	1,903,588	935,846	2,839,434

Of the 1359 contracts in the original data base, it was possible to calculate opportunity costs on 1335 contracts. Twenty-four C Category contracts lacked the information needed to calculate an overage time span necessary for opportunity cost calculations. The 888 contracts used in this study incurred 67 percent of the total opportunity cost.

Summary of Assumptions

The following assumptions were made so that this study could be accomplished:

1. The 28 February 1975 Contract Status Report reflected the most current reason code for the contract remaining overage.
2. The unliquidated obligation for each contract is an average value for the overage time span. The maximum value occurs when the contract is physically completed and the minimum value occurs when the contract is finally closed.
3. The administration of contracts within AFCMD is uniform for each AFPRO.
4. The transfer of all data elements from the CSR to the computer inputs for the BMD02R Stepwise Regression Model was precise.
5. All of the assumptions necessary to perform regression have been fulfilled.
6. The distribution of the mean face values of the Monthly Contract Status Report are assumed to be normal.
7. All overage contracts administered by AFCMD are listed in the Physically Complete Section of the CSR.

8. The reason code listed on the CSR represents the one and only reason the contract is in the overage status.

Summary of Limitations

The limitations of this study are as follows:

1. Conclusions will be limited to those contracts which are defined in the population.

2. The models developed are descriptive in nature and reflect only those interactions which the BMD02R model is able to compute. The fact that the regression equations are models restricts their use in real world application.

3. All predictions or inferences will be based on decision rules and are not in any way meant to be derogatory or critical of present management practices.

4. It is not known whether the reason code on the Contract Status Report reflects the reason the contract went overage or is the reason the contract is presently overage.

5. More than one overage reason code was reflected for 272 contracts. The initial reason listed in the CSR was arbitrarily selected for inclusion in the regression model.

6. A substantial number of contracts reported in the CSR lacked sufficient data to be included in the study. Most conspicuous was the absence of overage reason codes for 438 contracts.

7. A total of nine high value contracts were deleted because their face value was greater than three standard deviations away from the mean face value.

8. The models do not meet the assumption of randomness for the error terms of the dependent variable.

9. Where the Revised Milestone Closing Date has been exceeded and not updated, the 28 February 1975 report date was used to calculate the overage time span.

10. Where the Original Milestone Closing Date had been exceeded and no Revised Milestone Closing Date had been annotated, the 28 February 1975 report date was used to calculate the overage time span.

CHAPTER IV

STATISTICAL AND PRACTICAL SIGNIFICANCE OF RESEARCH HYPOTHESES

Introduction

This chapter relates the findings of Chapter III to:

Research Hypotheses 1 - BX_{23} ; CX_{23}

Research Hypotheses 2 - BX_{24} ; CX_{24}

Research Hypotheses 3 - BX_{1-22} ; CX_{1-22}

Research hypotheses related to Category A are not discussed in this chapter. There was an insufficient number of observations to form a valid sample for Category A (reference page 47, Category A Contracts).

The format for presentation of Research Hypotheses 1 - BX_{23} ; CX_{23} and Research Hypotheses 2 - BX_{24} ; CX_{24} is similar. The research hypothesis is stated, the tests for statistical and practical significance are illustrated, and the results of these tests are discussed. The presentation of Research Hypotheses 3 - BX_{1-22} ; CX_{1-22} , however, does not follow the same format. The large number of research hypotheses required that they be summarized according to those hypotheses that were supported and those hypotheses that were not supported for Categories B and C. A summary of research

hypotheses test results is presented in Table 17, page 71.

A test of practical significance of Research Question

1 - B; C follows the summary of the research hypotheses.

Research Hypotheses Related to Face Value

Research Hypotheses 1 - BX_{23} ; CX_{23}

There is a relationship between the time span a contract is overage and the face value of the contract.

Findings

The test of statistical significance performed on the face value variable, X_{23} , was the T-test. The null and the alternate hypotheses for this T-test were:

$$H_0: B_{23} = 0$$

$$H_1: B_{23} \neq 0$$

The null was rejected only if $t_{\text{samp}} > t_{\text{crit}}$ at a significance level of .99. The sample values and critical values of t for the research hypotheses were:

$$1 - BX_{23} \quad t_{\text{samp}} = .512 \quad t_{\text{crit}} = 2.657$$

$$1 - CX_{23} \quad t_{\text{samp}} = 2.798 \quad t_{\text{crit}} = 2.576$$

The above comparison shows that there is no statistical significance for Category B contracts. Therefore, Research Hypothesis 1 - BX_{23} cannot be supported. Research Hypothesis 1 - CX_{23} , on the other hand, is statistically significant and the null hypothesis can be rejected. The rule of practical

significance is then applied. This rule states: An independent variable is considered to be practically significant if it increased the overage time span by at least .33 years (reference page 34). Therefore, only contracts with a face value of \$25.4 million, or more, should be considered practically significant.

Research Hypotheses Related to Unliquidated Obligation

Research Hypotheses 2 - BX_{24} ; CX_{24}

There is a relationship between the time span a contract is overage and the unliquidated obligation.

Findings

The test for statistical significance of the ULO variable, X_{24} , is also the T-test. The null and the alternate hypotheses are represented as:

$$H_0: B_{24} = 0$$

$$H_1: B_{24} \neq 0$$

Once again, the null was rejected only if $t_{\text{samp}} > t_{\text{crit}}$ at a significance level of .99. The sample and critical values of t for the research hypotheses were:

$$2 - BX_{24} \quad t_{\text{samp}} = .583 \quad t_{\text{crit}} = 2.657$$

$$2 - CX_{24} \quad t_{\text{samp}} = 2.579 \quad t_{\text{crit}} = 2.576$$

The above comparison shows that for Category B contracts ULO is not statistically significant. Therefore, Research Hypothesis 2 - BX₂₄ cannot be supported. Research Hypothesis 2 - CX₂₄, on the other hand, is statistically significant, and the null hypothesis can be rejected. Again, applying the rule of practical significance for independent variables, Category C contracts which have an unliquidated obligation of \$108,600 should be considered practically significant.

Statistical and Practical Significance of
Reason Code Research Hypotheses

The test used to establish statistical significance for Category B and Category C Reason Code Research Hypotheses was the T-test. The null and the alternate hypotheses for this test were established in the following manner:

$$H_0: B_i = 0$$

$$H_1: B_i \neq 0$$

where,

i = 1,2,4,6,10,17,18,19,20,21 for Category B Contracts

i = 1,2,4,5,6,8,9,10,12,13,14,15,17,19,20,22 for
Category C Contracts

For each of the above hypotheses, $t_{\text{samp}} > t_{\text{crit}}$; therefore, H_0 was rejected at a significance level of .99. The value of t_{crit} for Category B is 2.657. The value of t_{crit} for Category C is 2.576. T_{samp} for each T-test is presented with the respective research hypothesis.

In addition to being statistically significant, all of the research hypotheses presented below were deemed to be practically significant. The decision rule for practical significance follows: a reason code is considered to be practically significant if it caused the overage time span to exceed .33 years. An expert in the field of contract-closure has stated that the "unofficial" administrative grace period is .33 years (6).

Support of Category B Reason Code
Research Hypotheses

Research Hypothesis 3 - BX_1

There is a relationship between the time span a contract is overage and the overage reason code A.

This relationship is statistically significant when a contract coded with overage reason code A is compared to a contract with overage reason code T. T_{samp} for the respective comparison was 3.21.

Research Hypothesis 3 - BX_2

There is a relationship between the time span a contract is overage and the overage reason code B.

This relationship is statistically significant when a contract coded with overage reason code B is compared to a contract with overage reason code T. T_{samp} for the respective comparison was 3.16.

Research Hypothesis 3 - BX₄

There is a relationship between the time span a contract is overage and the overage reason code D.

This relationship is statistically significant when a contract coded with overage reason code D is compared to a contract with overage reason code F. T_{samp} for the respective comparison was 3.14.

Research Hypothesis 3 - BX₆

There is a relationship between the time span a contract is overage and the overage reason code F.

This relationship is statistically significant when a contract coded with overage reason code F is compared to a contract with any one of the following overage reason codes: D, S, or T. T_{samp} for the respective comparisons was: 3.14, 2.80, and 4.19.

Research Hypothesis 3 - BX₁₀

There is a relationship between the time span a contract is overage and the overage reason code K.

This relationship is statistically significant when a contract coded with overage reason code K is compared to a contract with overage reason code T. T_{samp} for the respective comparison was 3.60.

Research Hypothesis 3 - BX₁₇

There is a relationship between the time span a contract is overage and the overage reason code S.

This relationship is statistically significant when a contract coded with overage reason code S is compared to a contract with overage reason codes F or W. T_{samp} for the respective comparisons was 2.80 and 2.68.

Research Hypothesis 3 - BX₁₈

There is a relationship between the time span a contract is overage and the overage reason code T.

This relationship is statistically significant when a contract coded with overage reason code T is compared to a contract with any one of the following overage reason codes: A, B, F, K, U, V, or W. T_{samp} for the respective comparisons was: 3.10, 2.82, 4.20, 3.23, 3.62, 3.20, and 4.04.

Research Hypothesis 3 - BX₁₉

There is a relationship between the time span a contract is overage and the overage reason code U.

This relationship is statistically significant when a contract coded with overage reason code U is compared to a contract with overage reason code T. T_{samp} for the respective comparison was 3.52.

Research Hypothesis 3 - BX₂₀

There is a relationship between the time span a contract is overage and the overage reason code V.

This relationship is statistically significant when a contract coded with overage reason code V is compared to a contract with overage reason code T. T_{samp} for the respective comparison was 3.15.

Research Hypothesis 3 - BX₂₁

There is a relationship between the time span a contract is coverage and the coverage reason code W.

This relationship is statistically significant when a contract coded with coverage reason code W is compared to a contract with any one of the following coverage reason codes: D, S, or T. T_{samp} for the respective comparisons was: 2.84, 2.68, and 4.03.

Support of Category C Reason Code Research Hypotheses

Research Hypothesis 3 - CX₁

There is a relationship between the time span a contract is coverage and the coverage reason code A.

This relationship is statistically significant when a contract coded with coverage reason code A is compared to a contract with any one of the following coverage reason codes: B, D, E, F, J, K, M, P, Q, S, U, or V. T_{samp} for the respective comparisons was: 2.78, 3.65, 9.23, 6.73, 2.59, 6.15, 11.47, 6.33, 6.55, 4.64, 7.91, and 3.80.

Research Hypothesis 3 - CX₂

There is a relationship between the time span a contract is coverage and the coverage reason code B.

This relationship is statistically significant when a contract coded with coverage reason code B is compared to a contract with coverage reason code A. T_{samp} for the respective comparison was 2.78.

Research Hypothesis 3 - CX₄

There is a relationship between the time span a contract is overage and the overage reason code D.

This relationship is statistically significant when a contract coded with overage reason code D is compared to a contract with overage reason code A. T_{samp} for the respective comparison was 3.65.

Research Hypothesis 3 - CX₅

There is a relationship between the time span a contract is overage and the overage reason code E.

This relationship is statistically significant when a contract coded with overage reason code E is compared to a contract with any one of the following overage reason codes: A, H, N, Q, S, or X. T_{samp} for the respective comparisons was: 9.23, 5.02, 2.74, 4.31, 5.91, and 2.67.

Research Hypothesis 3 - CX₆

There is a relationship between the time span a contract is overage and the overage reason code F.

This relationship is statistically significant when a contract coded with overage reason code F is compared to a contract with any one of the following overage reason codes: A, H, Q, or S. T_{samp} for the respective comparisons was: 6.73, 4.05, 2.72, and 3.92.

Research Hypothesis 3 - CX₈

There is a relationship between the time span a contract is overage and the overage reason code H.

This relationship is statistically significant when a contract coded with overage reason code H is compared to a contract with any one of the following overage reason codes: E, F, K, M, P, or U. T_{samp} for the respective comparisons was: 5.02, 4.05, 3.55, 4.08, 3.51, and 4.76.

Research Hypothesis 3 - CX_9

There is a relationship between the time span a contract is overage and the overage reason code J.

This relationship is statistically significant when a contract coded with overage reason code J is compared to a contract with overage reason code A. T_{samp} for the respective comparison was 2.59.

Research Hypothesis 3 - CX_{10}

There is a relationship between the time span a contract is overage and the overage reason code K.

This relationship is statistically significant when a contract coded with overage reason code K is compared to a contract with any one of the following overage reason codes: A, H, or S. T_{samp} for the respective comparisons was: 6.15, 3.55, and 3.35.

Research Hypothesis 3 - CX_{12}

There is a relationship between the time span a contract is overage and the overage reason code M.

This relationship is statistically significant when a contract coded with overage reason code M is compared to a contract with any one of the following overage reason codes:

A, H, Q, and S. T_{samp} for the respective comparisons was: 11.47, 4.08, 3.23, and 5.69.

Research Hypothesis 3 - CX_{13}

There is a relationship between the time span a contract is overage and the overage reason code N.

This relationship is statistically significant when a contract coded with overage reason code N is compared to a contract with any one of the following overage reason codes: E or U. T_{samp} for the respective comparisons was 2.74 and 2.73.

Research Hypothesis 3 - CX_{14}

There is a relationship between the time span a contract is overage and the overage reason code P.

This relationship is statistically significant when a contract coded with overage reason code P is compared to a contract with any one of the following overage reason codes: A, H, or S. T_{samp} for the respective comparisons was: 6.33, 3.51, and 3.34.

Research Hypothesis 3 - CX_{15}

There is a relationship between the time span a contract is overage and the overage reason code Q.

This relationship is statistically significant when a contract coded with overage reason code Q is compared to a contract with any one of the following overage reason codes: A, E, F, M, or U. T_{samp} for the respective comparisons was: 6.55, 4.31, 2.72, 3.23, and 3.81.

Research Hypothesis 3 - CX₁₇

There is a relationship between the time span a contract is overage and the overage reason code S.

This relationship is statistically significant when a contract coded with overage reason code S is compared to a contract with any one of the following overage reason codes: A, E, F, K, M, P, or U. T_{samp} for the respective comparisons was: 4.64, 5.91, 3.92, 3.35, 5.69, 3.34, and 4.05.

Research Hypothesis 3 - CX₁₉

There is a relationship between the time span a contract is overage and the overage reason code U.

This relationship is statistically significant when a contract coded with overage reason code U is compared to a contract with any one of the following overage reason codes: A, H, N, Q, S, or X. T_{samp} for the respective comparisons was: 7.91, 4.76, 2.73, 3.81, 4.05, and 2.66.

Research Hypothesis 3 - CX₂₀

There is a relationship between the time span a contract is overage and the overage reason code V.

This relationship is statistically significant when a contract coded with overage reason code V is compared to a contract with overage reason code A. T_{samp} for the respective comparison was 3.80.

Research Hypothesis 3 - CX₂₂

There is a relationship between the time span a contract is overage and the overage reason code X.

This relationship is statistically significant when a contract coded with overage reason code X is compared to a contract with any one of the following overage reason codes: E or U. T_{samp} for the respective comparisons was 2.67 and 2.66.

Statistical Test of Research Hypotheses Not Supported

The test used to indicate statistical significance was the t-test. The null and alternate hypotheses for this test were established in the following manner:

$$H_0: B_i = 0$$

$$H_1: B_i \neq 0$$

where,

$i = 8, 9, 12, 15$ for Category B Contracts

$i = 7, 21$ for Category C Contracts

For each of the above hypotheses, $t_{\text{samp}} < t_{\text{crit}}$; therefore, H_0 was not rejected. The value of t_{crit} for Category B remains 2.657. The value of t_{crit} for Category C remains 2.576. T_{samp} for each of the research hypotheses not supported was less than t_{crit} . The value of t_{crit} was established at the .99 level of significance.

Non-Support of Category B Reason Code
Research Hypotheses

Twelve of the twenty-two Category B overage reason codes were not statistically significant. Therefore, the research hypotheses for these reason codes could not be supported. There were no observations for eight of the twelve research hypotheses not supported. Table 15 presents the research hypotheses that were not supported.

Table 15

Non-Support of Category B Reason Code
Research Hypotheses

<u>Research Hypothesis 3 - BX_i</u>		<u>Overage Reason Code</u>
where	$i = 3$	C - No Observations
	5	E - No Observations
	7	G - No Observations
	8	H
	9	J
	11	L - No Observations
	12	M
	13	N - No Observations
	14	P - No Observations
	15	Q
	16	R - No Observations
	22	X - No Observations

Non-Support of Category C Reason Code
Research Hypotheses

Six of the twenty-two Category C overage reason codes were not statistically significant. Therefore, the research hypotheses for these reason codes could not be

supported. There were no observations for four of the six research hypotheses not supported. Table 16 presents the research hypotheses that were not supported.

Table 16

Non-Support of Category C Reason Code
Research Hypotheses

Research Hypothesis 3 - CX ₁		Overage Reason Code
where	i = 3	C - No Observations
	7	G
	11	L - No Observations
	16	R - No Observations
	18	T - No Observations
	21	W

Summary of Research Hypotheses

Table 17, page 71, presents a summary of Research Hypotheses 1 through 24 for Category B and Category C contracts. For Category B contracts, ten of the variables were statistically significant, eight variables had no observations, and six variables showed no statistical significance.

For Category C contracts, eighteen of the variables were statistically significant, four variables had no observations, and two variables showed no statistical significance.

Table 17

Summary of Research Hypotheses Test Results

Variable Name	Research Hypothesis	Category B(#)		Category C(#)	
		Reject	No Reject	Reject	No Reject
Face Value	1 - #X ₂₃		0	x	
ULO	2 - #X ₂₄		0	x	
A	3 - #X ₁	x		x	
B	3 - #X ₂	x		x	
C	3 - #X ₃		*		*
D	3 - #X ₄	x		x	
E	3 - #X ₅		*	x	
F	3 - #X ₆	x		x	
G	3 - #X ₇		*		0
H	3 - #X ₈		0	x	
J	3 - #X ₉		0	x	
K	3 - #X ₁₀	x		x	
L	3 - #X ₁₁		*		*
M	3 - #X ₁₂		0	x	
N	3 - #X ₁₃		*	x	
P	3 - #X ₁₄		*	x	
Q	3 - #X ₁₅		0	x	
R	3 - #X ₁₆		*		*
S	3 - #X ₁₇	x		x	
T	3 - #X ₁₈	x			*
U	3 - #X ₁₉	x		x	
V	3 - #X ₂₀	x		x	
W	3 - #X ₂₁	x			0
X	3 - #X ₂₂		*	x	

* No Observations

x Statistically Significant

0 Not Statistically Significant

Practical Significance of Research
Questions 1 - B; C

Research Questions 1 - B; C

Is a disproportionate amount of opportunity cost caused by a small number of overage reason codes?

Findings

The practical significance of Research Questions 1 - B; C was tested by the application of the following two criteria:

1. A group of statistically significant reason codes which account for less than fifty percent of the twenty-two overage reason codes must be identified.
2. The above group must be responsible for more than fifty percent of the total available opportunity cost for that category of contracts.

If this decision rule is applied to the reason codes asterisked on Tables 10 and 11, pages 48-49, the practical significance of Research Questions 1 - B; C may be tested. A summary of the results from the test is presented in Table 18. Research Question 1 - C is practically significant. Research Question 1 - B is not practically significant.

Table 18
 Practical Significance of Research Question 1 - B; C

Research Hypothesis	Codes Having Tendency to Increase Overage Time Span	% of Total Opportunity Cost	Support of Practical Significance
1 - B	3	4.03%	No
1 - C	6	65.41%	Yes

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY

Overview

This chapter contains the conclusions of the research effort. Conclusions associated with the research hypotheses and conclusions associated with the research questions are presented first. These conclusions are followed by related corollary conclusions. Recommendations for future study are discussed after the corollary conclusions. Finally, a brief summary of the study is presented.

Conclusions

A major part of this research effort was concerned with the relationship between the time span a contract is overage and the face value of the contract. The time span a contract is overage tends to increase as the face value of the contract increases. The Category C contracts have the largest mean face value and the longest mean time overage. Category B contracts have the next largest mean face value and the next longest mean time overage. These results illustrate a contradiction in priorities. It would seem that the contracts with the highest face value should receive more management attention than those with the smaller face value. However, this is not the case. The magnitude of the face

value of the contract is a detriment to a timely closure process. The higher the face value the longer the contract remains overage. Several conclusions can be drawn from this fact: (1) management should devote more time to contracts with high face value throughout the entire closure process; (2) Category C contracts, contracts with the highest mean overage time span, will demand more administrative effort if a timely closure is to be accomplished; and (3) the closure process for high value contracts becomes additionally complex and does not allow the contract to be closed within present ASPR time standards. In conclusion, substantial savings, in terms of administrative and opportunity costs, can be obtained if more management effort is directed toward high dollar contracts during the contract-closure process.

A second area of analysis was concerned with the relationship between the unliquidated obligation remaining on a contract at the time it goes overage and the overage time span. The investigation indicated that as the amount of ULO increased the overage time span decreased. There are several possible explanations for this phenomena. Since the funds have been obligated to the contract, but have not yet been paid, the contractor will fulfill his obligations in the closure process at a more rapid rate. Second, a conscious effort on the part of the administrative contracting officer to deobligate the funds focuses attention on the contract. This additional attention results in a more timely contract-closure. Finally, there may be a synergistic effect

resulting from a cooperative effort on the part of the government and contractor to remove excess ULO. This cooperation for mutual benefit may promote prompt closure of the contract. Conversely, as the amount of ULO decreases, the overage time span increases. The absence of ULO or a relatively small amount of obligated funds remaining on contract may, in itself, have a negative effect on the contract-closure process. Since the money involved may be regarded as insignificant, there may be a lack of motivation to effect prompt and timely administrative action. Consequently, the contract-closure process may be lengthened unnecessarily, further contributing to the total administrative effort required.

The third facet of this study addressed the relationships between the individual overage reason codes and the time span a contract was overage. The research uncovered both expected results and peculiarities in the Category B and C contracts. The conclusions which can be drawn from these results must be treated separately.

Category B contracts had only three reason codes which were comparatively unique. These reason codes were:

- (D) Patent/royalty clearance required
- (S) Litigation/investigation pending
- (T) Termination

The above reason codes tended to keep a Category B contract open longer than the other codes within this category. The appearance of Reason Code D indicates that patent and royalty clearance for fixed price contracts needs added emphasis and

monitoring. The fact that litigation/investigation, Reason Code S, caused contracts to be open longer was not surprising. Prior to performing analysis several personnel responsible for contract-closure activities indicated that litigation of contracts would prove to be a stumbling block in the timely closure of contracts. Personnel interviewed stated a belief that closer management scrutiny would prevent the contract from entering that area of conflict. A discussion of contractual controls to eliminate constructive change notices and other contractual conditions which generate claims on the part of the contractor is beyond the scope of this research. The appearance of Reason Code T, Termination, although surprising, is not without explanation. The contractor is allowed one year to submit his final voucher in the case of termination whereas the time span allowed for closure of Category B contracts is only six months. It can be concluded, therefore, that there is a basic conflict between closure and termination procedures. This conflict in procedures should be corrected by the ASPR Committee.

A different group of overage reason codes are tending to keep Category C contracts overage. These reason codes are:

- (A) Contractor has not submitted final invoice/
voucher
- (H) Final audits in process
- (N) Additional funds requested but not yet received
- (Q) Armed Services Board of Contract Appeals (ASBCA)
case

(S) Litigation/investigation pending

(X) Contract release and assignment pending

Two of the above six reason codes, Q and S, are related to the appeals procedures of contract administration. These findings supported a priori beliefs concerning the ASBCA and litigation. A contract coded with these reason codes does, in fact, have an extended overage time span. The fact that Reason Code H appeared to be an influence in lengthening the overage time span suggests that the Defense Contract Audit Agency (DCAA) is placing more emphasis on the audit of estimated costs in comparison to costs already incurred. Reason Code N, however, may be the key to the appearance of the other reason codes, excluding Q and S. Reason Code N might be appearing because of excessive deobligation of funds remaining on a contract. If excessive funds are deobligated, and not enough ULO remains to make final payment, additional funds must be requested. This will delay submission of the contractor's final voucher. The final audit will, in turn, be delayed as will the contract release. More precise calculation of the amount of ULO to be deobligated could preclude this chain of events and the resulting increase in overage time span. To summarize, it can be stated that individual overage reason codes are factors in the length of time a contract remains overage. As presented in Chapter III, Table 9, page 43, each reason code is associated with a unique increment of overage time span. The overage time span

will thus vary according to the reason code causing the contract to go overage.

The final conclusions are related to Research Questions 1 - B; C. Category B contracts do not have a small group of overage reason codes which account for a large portion of the total opportunity cost calculated for this category. This fact indicates that those reason codes which keep contracts overage longer are not related to contracts that have large amounts of ULO, which ultimately result in opportunity costs. Category C contracts, on the other hand, have a group of six reason codes which account for over 65 percent of the total opportunity cost calculated for Category C. These reason codes and their associated explanations are:

- (A) Contractor has not submitted final voucher/
invoice
- (H) Final audit in process
- (N) Additional funds requested but not yet received
- (Q) Armed Services Board of Contract Appeals (ASBCA)
case
- (S) Litigation/investigation pending
- (X) Contract release and assignment pending

The above six reason codes are the same as those shown to keep Category C contracts overage comparatively longer than the other overage reason codes. They are also responsible for a majority of the opportunity cost incurred. Therefore, management emphasis on the high value Category C contracts

in these specific areas can help preclude overage contracts and thus reduce opportunity costs.

Corollary Conclusions

Although not statistically supported, several corollary conclusions may be drawn from the data reviewed during this investigation:

1. The Contract Status Report (CSR) issued at Headquarters, Air Force Contract Management Division, appears to be receiving insufficient attention from contract administration personnel. The absence of overage reason codes, and the use of multiple reason codes are evidence of inconsistency in reporting. Of the 1359 overage contracts listed on the 28 February 1975 CSR, only 888 were included in this study because of anomalies in the data base. Appendix E, page 97, provides a summary of the contracts deleted from the data base.

2. The Category A contracts have the lowest dollar value and consequently the lowest ULO. The small dollar amounts involved probably account for the apparent lack of emphasis placed on the closure of these type contracts. Further, DD Form 1597, the Contract-Closure Check-List, does not consider the closure process for Category A contracts (reference Appendix A, page 83). As a result, 94 percent of the Category A contracts on the 28 February 1975 CSR did not have an overage reason code.

3. Not enough emphasis is being placed on the closure of contracts. The fact that opportunity costs of

approximately 2.8 million dollars was calculated on the overage contracts under study for this report indicates that the system could be improved. Since the other Department of Defense contract administration components are assumed to use similar procedures, there is a possibility that they may have similar problems.

4. Twenty-four contracts with larger than average face value and unliquidated obligation had no Original Milestone Closing Date, but did have a Revised Milestone Closing Date. Since 27 percent of the total ULO listed on the CSR is attributable to these contracts, it would appear that a significant amount of opportunity cost is being incurred by these contracts. Management attention to these selected contracts would probably result in substantial opportunity cost savings.

5. This research has not addressed the administrative costs associated with the contract-closure process. At this time, it is not possible to estimate the number of actions or the amount of time expended trying to close an individual contract each month. However, it appears that an extended contract-closure process is time consuming and costly.

6. The models used considered only the effect of face value, unliquidated obligation, and overage reason code. The results indicated that behavioral variables of the contract-closure process may be affecting the overage time span.

7. Category C contracts have a tendency to be overage longer than Category A and Category B contracts. This fact provides support for and closely parallels the difference in the closure-time standards contained in ASPS 2-305.

8. An increase in the closure-time standards specified in ASPS 2-305 is not a possible solution to the problem of overage contracts. An increase in the time standards would be an administrative cover to hide the problem and would not treat the cause.

Recommended Future Studies

During the course of this research effort, several topics which warrant future research were encountered. A discussion of these topics follows:

1. This study was confined to contracts being administered by AFCMD. No data was obtained on DCAS contracts. Therefore, we recommend that a similar study be conducted to analyze the overage time spans and opportunity cost of contracts under the jurisdiction of DCAS. The authors believe that since the ASPR applies to both organizations, the results would be similar in both studies.

Similar studies could be performed on NASA contracts being administered by AFCMD. Currently, information on NASA contracts is not reflected in the physically complete section of the CSR.

2. The administrative procedures of the contract-closure process should be reviewed. A study to examine the

methodology used by ACO's to effect contract-closure could have an impact on decreasing the overage time span.

3. A study to determine the administrative costs associated with the contract-closure process should be conducted. There is evidence which indicates that the costs associated with not closing a contract might be excessive.

4. A corollary study to determine the disposition of ULO should be performed. The specific question which should be answered is: Of those contracts physically complete with ULO remaining, what percentage of the ULO is ultimately released to other government programs?

5. The question of the usefulness of the CSR should be examined in detail. Is the report being prepared properly and does the existence of this report prompt contract management personnel to take timely action to complete the closure process?

Summary

The contract-closure process receives a low priority on the list of contract administration activities. The fact that at least 2.8 million dollars of opportunity cost is being incurred by the overage contracts being administered by AFQMD emphasizes this fact. All organizations concerned with the contract-closure process should place more emphasis on this aspect of contract administration. There is a need for a review and consolidation of the policies and procedures related to contract-closure.

APPENDIX A

FORMS RELATED TO CONTRACT-CLOSURE

1. DD Form 1597--Contract Close-Out Checklist
2. DD Form 1593--Contract Administration Completion Record
3. DD Form 1594--Contract Completion Statement

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CONTRACT CLOSEOUT CHECK-LIST		CONTRACT NUMBER	
NAME OF CONTRACTOR		AS AMENDED BY MODIFICATIONS NUMBERED THROUGH	
DATE OF PHYSICAL COMPLETION	MILESTONES/CALENDAR DAYS AFTER PHYSICAL COMPLETION	FORECAST FOR COMPLETION (Date)	ACTION COMPLETED (Date) (Y/N) If not applicable
ACTION ITEMS	CATEGORY B	CATEGORY C	
DISPOSITION OF CLASSIFIED MATERIAL COMPLETED			
FINAL PATENT REPORT SUBMITTED (Inventions Disclosure)			
FINAL INVALTY REPORT SUBMITTED			
FINAL PATENT REPORT CLEARED (Inventions Disclosure)			
FINAL INVALTY REPORT CLEARED			
NO OUTSTANDING VALUE ENGINEERING CHANGE PROPOSAL (VECP)			
PLANT CLEARANCE REPORT RECEIVED			
PROPERTY CLEARANCE RECEIVED			
SETTLEMENT OF ALL INTERIM OR DISALLOWED COSTS (BCAA Form 1)			
PRICE REVISION COMPLETED			
SETTLEMENT OF SUBCONTRACTS BY THE PRIME CONTRACTOR			
PRIME VSAN OVERHEAD RATES COMPLETED			
CONTRACTOR'S CLOSING STATEMENT RECEIVED			
TERRITORIAL DECREE COMPLETED			
CONTRACT AUDIT COMPLETED			
CONTRACTOR'S CLOSING STATEMENT COMPLETED			
FINAL VOUCHER SUBMITTED			
FINAL PAID VOUCHER RECEIVED			
ISSUANCE OF REPORT OF CONTRACT COMPLETION			
FINAL REMOVAL OF EXCESS FUNDS RECOMMENDED			
ISSUANCE OF CONTRACT COMPLETION STATEMENT	180	600	
OTHER REQUIREMENTS COMPLETED (Specify)			
REMARKS (Continue on reverse side if necessary)			
TYPED NAME AND TITLE OF RESPONSIBLE OFFICIAL	SIGNATURE (To be signed only upon completion of all actions)		DATE

DD FORM 1597

REPLACES EDITION OF 1 FEB 67 WHICH WILL BE USED UNTIL EXHAUSTED

CONTRACT ADMINISTRATION COMPLETION RECORD		1. SUSPENSE DATE			
2. FROM		3. CONTRACT NUMBER			
		AS AMENDED BY MODIFICATION NUMBERS THROUGH _____			
4. YES (Organizational element performing function checked below)		5. NAME OF CONTRACTOR			
The contract identified above has been physically completed (i.e., all required deliveries or shipments have been made and/or services performed or terminated). Request column 6c or 6d and 6e and 6f be completed with regard to the function checked in column 6a and this form returned by the suspense date indicated in item 1. If only an anticipated date of completion of required actions can be given by the suspense date, a subsequent advice of final action is requested. If contract being closed is classified, send signed copy of this form marked "INFORMATION COPY" to cognizant Industrial Security Office.					
6. STATUS OF ACTION(S)					
"R"	FUNCTION	"R" IF REQUIRED ACTION(S) COMPLETED	ANTICIPATED DATE FOR COMPLETION OF ACTION(S)	SIGNATURE	DATE
R	a	c	d	e	f
	PROPERTY ADMINISTRATION				
	PLANT CLEARANCE				
	CONTRACT TERMINATION				
	OTHER (Specify)				
7. REMARKS					
8. TYPE NAME OF RESPONSIBLE OFFICIAL			9. SIGNATURE		10. DATE

DD FORM 1583
1 APR 66

REPLACES EDITION OF 1 FEB 67 WHICH IS OBSOLETE.

GPO 674-573

CONTRACT COMPLETION STATEMENT		
1. FROM: (Contract Administration Office)		2a. PH NUMBER
		2b. LAST MODIFICATION NUMBER
		2c. CALL/ORDER NUMBER
3. TO: (Name and Address of Purchasing Office and OIP - symbol of the PCO, if known)		4. CONTRACTOR IDENTITY CODE AND ADDRESS
		5. EXCESS FUNDS ☐ YES ☐ NO
		\$ _____
6a. IF FINAL PAYMENT HAS BEEN MADE, COMPLETE ITEMS 6b., AND 6c.	6b. VOUCHER NUMBER	6c. DATE
7a. IF FINAL APPROVED INVOICE FORWARDED TO O.O. OF ANOTHER ACTIVITY AND STATUS OF PAYMENT IS UNKNOWN, COMPLETE ITEMS 7b. AND 7c.	7b. INVOICE NUMBER	7c. DATE FORWARDED
8. REMARKS		
9a. ALL ADMINISTRATION OFFICE ACTIONS REQUIRED HAVE BEEN FULLY AND SATISFACTORILY ACCOMPLISHED. THIS INCLUDES FINAL SETTLEMENT IN THE CASE OF A PRICE REVISION CONTRACT		
9b. TYPEO NAME OF RESPONSIBLE OFFICIAL	9c. SIGNATURE	9d. DATE
FOR PURCHASING OFFICE USE ONLY		
10a. ALL PURCHASING OFFICE ACTIONS REQUIRED HAVE BEEN FULLY AND SATISFACTORILY ACCOMPLISHED. CONTRACT FILE OF THIS OFFICE IS HEREBY CLOSED AS OF:		
☐ DATE SHOWN IN ITEM 9d. ABOVE. ☐ DATE SHOWN IN ITEM 10b. BELOW. (Check this box only if final completion of any significant purchasing office action extends more than three months beyond close-out date shown in item 9d. above. In such cases, submit a copy of the completed form upon final accomplishment of all purchasing office actions to the contract administration office. (Upon receipt, the contract administration office shall extend its contract file close out date accordingly.))		
10b. REMARKS		
10c. TYPEO NAME OF RESPONSIBLE OFFICIAL	10d. SIGNATURE	10e. DATE

APPENDIX B

LIST OF PERSONNEL INTERVIEWED

1. Crawford, Mr. Jack R. Auditor, Air Force Audit Agency, Office of the Air Force Auditor General, Wright-Patterson AFB, Ohio. Personal interview. 22 October 1974.
2. Emmel, Ms. Jean. Data Specialist, Operations Reports and Records, Contract Policy Directorate, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Personal interview. 11 October 1974.
3. Fedele, Mr. Angelo. Contracting Officer, Directorate of Procurement and Production Support, Headquarters Air Force Systems Command, Washington, D.C. Personal telephone interview. 3 October 1974.
4. Kernan, Mr. Jack E. Closure Specialist, Contract-Closure Branch, Contract Policy Directorate, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Personal interview. 11 October 1974.
5. Michalowski, Major Thomas J. Research Associate, Air Force Business Research Management Center (Hq USAF), Wright-Patterson AFB, Ohio. Personal interview. 8 October 1974.
6. O'Neill, Mr. Donald J. Contracting Officer, Systems Program Office, Acquisition Management Information System (AMIS), Air Force Systems Command, Wright-Patterson AFB, Ohio. Personal interview. 9 October 1974.
7. Pfeifer, Mr. James. Contract Specialist, Air Force Plant Representative Office, Air Force Contract Management Division, Evendale, Ohio. Personal interview. 7 October 1974.
8. Poe, Major William E. Course Director, Advanced Contract Administration, Continuing Education Division, Air Force Institute of Technology, School of Systems and Logistics, Wright-Patterson AFB, Ohio. Personal interview. 29 October 1974.

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9. Schaeffer, Mr. James. Technical Assistant to the Director, Contract Policy Directorate, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Personal interview. 11 October 1974.
10. Schlobohm, Mr. William A. Contract Administrator, Contracts Division, Air Force Contract Management Division, Kirtland AFB, New Mexico. Personal interview. 27 November 1974.
11. Smallwood, Mr. Lowell S. Closure Specialist, Contract-Closure Branch, Contract Policy Directorate, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Personal interview. 11 October 1974.
12. Stubblebine, Captain Thomas J. Accountant, Comptroller's Office, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Personal interview. 22 October 1974.
13. Terzian, Mr. R. H. Course Director, Basic Contract Administration, Continuing Education Division, Air Force Institute of Technology, School of Systems and Logistics, Wright-Patterson AFB, Ohio. Personal interview. 29 October 1974.
14. Venn, Major Porter W. Chief, Accounting and Finance, Comptroller, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Personal interview. 23 October 1974.
15. Wallace, Mr. Max E. Logistics Specialist, Systems Program Office (AMIS), Air Force Systems Command, Wright-Patterson AFB, Ohio. Personal interview. 25 September 1974.

APPENDIX C

SUMMARY OF OPPORTUNITY COST

Opportunity Cost Summary--Category B

Reason Code	Explanation of Reason Codes	Number of Observations	ULO	Opportunity Cost
A	Contractor Final Voucher	21	\$447,646	\$ 65,396
B	Final Acceptance	3	1	0
C	Contractor Patent Report	0	0	0
D	Patent/Royalty Clearance	6	0	0
E	Final Price Redetermination	0	0	0
F	Supplemental Settlement	6	0	0
G	Subcontract Settlement	0	0	0
H	Final Audit	1	6,172	508
J	Disallowed Cost	1	1	0
K	Audit of Gov't Property	9	212,460	19,317
L	R&D Rates Pending	0	0	0
M	Overhead Rates	3	0	0
N	Additional Funds Requested	0	0	0
P	Reconciliation w/Finance	0	0	0
Q	ASBCA	2	7,861	995
R	Public Law 85-804 Case	0	0	0
S	Litigation	2	4,550	1,409

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Opportunity Cost Summary--Category B (continued)

Reason Code	Explanation of Reason Codes	Number of Observations	ULO	Opportunity Cost
T	Termination	5	\$ 49,867	\$ 3,288
U	Warranty Clause	7	82,829	23,888
V	Disposition Gov't Property	7	0	0
W	Contract Modification	6	36,479	1,780
X	Contract Release	<u>0</u>	<u>0</u>	<u>0</u>
	TOTAL	<u>79</u>	<u>\$847,865</u>	<u>\$116,581</u>

Opportunity Cost Summary--Category C

Reason Code	Explanation of Reason Codes	Number of Observations	ULO	Opportunity Cost
A	Contractor Final Voucher	108	\$1,098,933	\$ 359,322
B	Final Acceptance	5	16,468	2,225
C	Contractor Patent Report	0	0	0
D	Patent/Royalty Clearance	8	410	20
E	Final Price Redetermination	38	413,480	33,214
F	Supplemental Agreement	27	2,075,866	189,247
G	Subcontract Settlement	1	3,281	753
H	Final Audit	17	606,877	105,215
J	Disallowed Cost	4	4	108
K	Audit of Gov't Property	23	0	0
L	R&D Rates Pending	0	0	0
M	Overhead Rates	286	1,347,657	217,781
N	Additional Funds Requested	7	281	111
P	Reconciliation w/Finance	27	24,786	4,699
Q	ASBCA	97	1,116,997	181,960
R	Public Law 85-804 Case	0	0	0
S	Litigation	102	888,460	244,095
T	Termination	0	0	0
U	Warranty Clause	24	2,756	91
V	Disposition Gov't Property	12	68,339	170,044
W	Contract Modification	1	0	0
X	Contract Release	<u>10</u>	<u>851,021</u>	<u>278,115</u>
	TOTAL	<u>797</u>	<u>\$9,129,674</u>	<u>\$1,787,006</u>

APPENDIX D

SUMMARY OF CATEGORY C CONTRACTS WITH NO OVERAGE TIME SPAN

Contract Number	Face Value (Dollars)	ULO (Dollars)	Reason
1	60,756,331	104,228	X
2	206,176,807	308,974	XV
3	22,362,141	31,826	-
4	7,653,759	86,523	SQ
5	3,071,384	521	SQ
6	4,149,960	80,000	SQ
7	3,610,771	39,756	SQ
8	10,154,000	-	-
9	70,913,548	(-) 3,157,074	ST
10	250,000	4,111	HAU
11	25,100,000	-	MDV
12	16,506,575	77,248	MA
13	211,679,748	7,457	MG
14	246,063,747	-	F
15	101,780,266	200,628	-
16	101,386,141	777,131	Q
17	45,348,994	154,735	Q
18	805,095	-	M
19	4,521,889	52,213	J
20	16,974,260	30,293	M
21	191,358,910	19,116	M
22	122,023,623	90,835	M
23	49,982,000	38,510	M
24	<u>78,446,613</u>	<u>39,415</u>	A
TOTAL	1,601,076,562	5,300,594	
MEAN	66,111,523	220,858	

APPENDIX E

SUMMARY OF CONTRACTS DELETED FROM THE DATA BASE

Reason for Deletion	Category Type	Number in Category	Total Face Value (Dollars)	Mean Face Value (Dollars)	Total ULO (Dollars)	Mean ULO (Dollars)	Mean Time AVG. (Years)
No Reason Code	A	189	171,801	909	7,371	39	.46
	B	118	77,996,348	660,986	210,748	1,786	.59
	C	<u>131</u>	<u>799,496,537</u>	<u>6,103,027</u>	<u>1,155,027</u>	<u>8,817</u>	<u>.63</u>
	Subtotal	438	877,664,686		<u>1,373,146</u>		
Exceeded 3 Standard Deviations	A	None	-	-	-	-	-
	B	2	179,462,452	89,731,226	0	0	3.75
	C	<u>7</u>	<u>4,189,505,932</u>	<u>598,500,847</u>	<u>3,301,617</u>	<u>471,660</u>	<u>2.32</u>
	Subtotal	9	4,368,968,384		<u>3,301,617</u>		
Insufficient Data	C	<u>24</u>	<u>1,601,076,562</u>		<u>5,300,594</u>		
	TOTAL	<u>471</u>	<u>6,847,709,632</u>		<u>9,975,357</u>		

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12. U.S. Department of the Air Force. "Report from Physically Completed Contract File Data." Inter-staff letter by Colonel Leonard A. Staszak, Director of Procurement Support, Air Force Systems Command, Andrews AFB, Maryland, 29 August 1974.
13. U.S. Department of the Air Force. "Report from Physically Completed Contract File Data." Inter-staff letter by Lieutenant Colonel Philip B. Sussmann, Director, Contract Administration Division, Kirtland AFB, New Mexico, 12 September 1974.
14. U.S. Department of the Air Force. "Unliquidated Obligations (ULO) on Physically Completed Contracts Over \$25,000." Policy Directive by Lieutenant Colonel Robert E. Rihs, Chief, Contracts/Termination Division, Kirtland AFB, New Mexico, 11 September 1973.
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