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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides a analysis of the cancellation and termination aspects of multiyear procurements, and other appropriate procurements on major and some non-major weapon systems during the last two decades. Examples of commodity groups were identified for developing a rationale and methodology for establishing an actuarial account to enable DoD program managers to partially fund the cancellation ceilings on multiyear procurements.

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PHASE I FINAL REPORT
ANALYSIS OF CANCELLATION AND
TERMINATION ASPECTS OF MULTIYEAR PROCUREMENTS

Prepared for

The Defense Systems Management College
Fort Belvoir, Virginia 22060
Contract No. MDA 903-82-G-0047

" The views, opinions, and findings contained in this report are those of the author(s) and should not be construed as an official Department of Defense position, policy, or decision, unless so designated by other official documentation".

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January 26, 1983

Department of Defense
Defense Systems Management College
Ft. Belvoir, Virginia 22060

Attention: Ron Baker

Subject: Phase I Final Report on Analysis of Cancellation and Termination
Aspects of Multiyear Procurement (MYP) Under MDA 903-82-G-0047
Task 2

Dear Mr. Baker:

We are pleased to submit a Phase I Final Report addressing our efforts on Tasks A through E of the subject contract. This report follows our submission of other individual reports:

- . Task A (8/17/83)
- . Tasks B and C (10/8/82)
- . Tasks D and E (11/8/82)
- . Phase I Draft (12/3/82).

The report documents and expands upon our presentations at the Defense Systems Management College (DSMC) on 10/8/82, 11/8/82 and 1/4/83. It incorporates government and industry comments on the Phase I Draft Report received during the period 1/7/83 - 1/14/83. The report presents the initial data and analysis in the area of MYP contract applications in the 1962-1981 time frame. It focuses on savings accrued to the government, cancellation experience, and cancellation ceiling funding policies. Given the long-term historical nature of the data and the attendant data collection issues, certain of the requested items remain outstanding at this time, and will be addressed in our Phase II efforts.

The enclosed report is divided into an Executive Summary, four chapters and three appendices. Following the Executive Summary, an Introduction chapter provides an overview of the research objectives. The Background chapter describes the study scope, the research framework and specific tasks, as well as a brief historical perspective on MYP. Our Technical Approach chapter discusses MYP terminology, the data collection process, collected MYP data, MYP savings estimates, approaches to MYP funding, and cancellation ceiling adjustment issues. The final chapter; Findings, Conclusions, Recommendations, summarizes the results and provides an assessment of how those results bear on the process of implementing MYP on a wider scale for major systems.



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Department of Defense
January 26, 1983
Page 2

Based on the Phase I study effort, certain fertile areas for pursuit in Phase II are evident. DD Form 350 data, as described in the report, should be tested carefully to determine if it can identify further "major" system MYPs. Army and Air Force comptroller organizations should be contacted to pursue funding patterns, past and present, for MYPs. Cancellation ceiling data and cancellation funding data that have been requested, but not yet received, should be incorporated into the data base. The full range of data should then be further analyzed to develop fully a rigorous mathematical model relating the rate at which savings are accrued to the government relative to the way cancellation ceilings decline.

It has been our pleasure to have worked with you and the DSMC staff on this important undertaking. We fully appreciate the potential value of MYP to the acquisition process, and look forward to continuing efforts during Phase II. If you have any questions or problems, please feel free to call me at (703) 979-9100.

020-2/6"

Sincerely,


BOOZ-ALLEN & HAMILTON INC.

James M. Johnson
Vice President

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This Defense Systems Management College (DSMC) sponsored research focuses on the historical cancellation experience of multiyear procurement (MYP) during the 1962-1981 time period. Historical data are used to determine:

- savings associated with past MYPs
- cancellation experiences for MYP programs
- funding policies associated with past MYPs.

The research will be used to determine if valid reasons exist for DoD Program Managers to only partially fund cancellation ceilings on their MYPs. In undertaking the research, a two-phased program is being undertaken, with this document reflecting the initial results of the first phase. The study focuses on "major" systems rather than supplies and services, which have been procured more regularly using MYP vehicles.

MYP originated in the early 1960s in the Department of the Army, and was used on a limited basis for "major" systems during the 1960s. The Navy used MYPs for a number of shipbuilding programs in the mid-and late 1960s. With the cancellation of the LHA ship acquisition in 1972 and the attendant payment of a \$109.7M cancellation fee, Congress placed important restrictions on the use of MYP. During the ensuing 1973-1981 period, MYP continued to be used, but not at the same level as would have been expected without the legislative restrictions.

Deputy Secretary of Defense, Frank Carlucci, made MYP an important part of the Acquisition Improvement Program (AIP) in 1981. However, to implement MYP on a wider scale for major weapon systems, a major controversy must be resolved. This controversy centers on the degree to which cancellation ceilings should be fully funded by program managers. Congress, the Office of Management and Budget (OMB), the General Accounting Office (GAO), segments of the Office of the Secretary of Defense (OSD), and comptrollers believe that full funding is necessary, while other segments of OSD, contracting officers, service acquisition managers, and many acquisition policy analysts believe full funding will restrict the adoption of MYP. Through a focused data collection effort both in the literature and in interviews, specific data on past MYPs were collected to address this controversy.

Approximately 40 past MYPs were identified for ships, aircraft, electronics/communications, missiles, torpedoes, tracked vehicles, and trucks. Fully 60% of these MYPs were for ships and electronic/communications systems. The Army, Navy and Coast Guard have been the primary MYP users. Contract values ranged from a low of \$10M to over \$2B with an average of \$300M. No one MYP duration was used more than any other. Six MYPs were cancelled in some fashion, indicating a cancellation rate of approximately 14%, which is higher than previous studies have shown. The largest cancellation fee paid was \$109.7M with the others ranging from \$950K to \$15.3M. Although data have not been collected fully on all systems, cancellation fees paid, as a percentage of contract value, range up to a maximum of 6%.

The magnitude of historical savings from MYP were assessed, but not conclusively validated. The frequently cited 10%-30% MYP savings estimate was not validated, nor was a lower rate of 3%-8% postulated by GAO. It is clear that MYP savings are possible, and that they vary by commodity and by the structure of the MYP. A number of learning curve analyses indicate that 10%-15% savings from MYP are not unrealistic.

Collected data indicate that MYP cancellation ceilings have not always been fully funded during the 1962-1981 period in spite of full funding guidance. In some interviews, it was indicated that "precedence" exists for partial funding following the pattern of some Fixed Price Incentive (FPI) contracts in which price targets are budgeted rather than price ceilings. The U.S. Coast Guard and Maritime Administration have not always funded cancellation ceilings based on their perception of existing guidance to that effect for civilian agencies.

The government has an important position in determining the magnitude of the cancellation ceiling, especially as regards the recurring cost segment. The funding policy and profile used for an MYP are the primary determinants of the magnitude of the cancellation ceiling. While the data are incomplete regarding the determination of a rigorous "cross-over" point relating accrued MYP savings to potential cancellation losses, MYPs will reach a break even point before the mid-point of the MYP contract term.

Based on the successes and failures described in the full report, a number of recommendations are made. With a cancellation probability of 14%, it seems reasonable that partial funding is a valid approach to MYP. Additionally, there are numerous partial funding approaches available to the government in its financing of MYPs, some of which are more suitable to one commodity group vice another. MYPs might, in the future, be linked to those acquisitions having working Design-to-Cost programs during development to gain confidence in system unit costs. The DAR 1-322 guidance for level-priced MYPs, with no provisions for recurring costs to be included in the cancellation ceilings, should be changed. This regulation will restrict the successful implementation of MYP, and appears to be contrary to the goals of reducing acquisition costs.

I. INTRODUCTION

I. INTRODUCTION

As a result of Deputy Secretary of Defense Frank Carlucci's Acquisition Improvement Program (AIP) initiatives published in 1981, multiyear procurement (MYP) has become a prominent and hotly disputed topic. It has been identified as a contracting mechanism by which weapon system acquisition costs could be significantly reduced. Since MYP's resurrection in 1981, there has been and continues to be vigorous debate over the value of this acquisition strategy. To evaluate the real successes and failures of MYP, the Defense Systems Management College initiated a research task of past uses of MYP for major and non-major weapon systems.

The task, as described in the remainder of this report, uses historical data to determine:

- . savings accrued to the government through the use of MYP
- . cancellation experiences for MYP programs
- . funding policies associated with past MYPs.

These particular pieces of information are necessary to measure both past success and failures as well as to permit the formulation of recommendations for the expanded implementation of MYP in today's environment. The research will also be used to develop a rationale and methodology for establishing an actuarial account to enable Department of Defense (DoD) Program Managers to only partially fund the cancellation ceilings on their respective multiyear procurements.

Two important objectives of this research task have guided the study efforts:

- . develop a methodology for adjusting the magnitude of the cancellation ceiling (as a percentage of the total value of the contract) for various types of industries
- . develop formulas and/or methodologies for determining the value of partial coverage of the cancellation ceiling (as a percentage of the total value of the contract) in each industry during various economic periods.

By collecting and analyzing statistics from actual past MYPs in the areas of savings, cancellation experience, and funding policy, it is possible to address the above research objectives as called forth in the Statement of Work (SOW).

II. BACKGROUND

II. BACKGROUND

This section presents background material on the general topic of MYP as well as specific aspects relative to this research. The scope of the study is described first, followed by a brief overview of the individual tasks from the SOW comprising the study. The final section briefly traces the evolution of MYP from the early 1960s to today's environment with an emphasis on the major controversies facing the respective proponents and opponents.

1. SCOPE

This research focuses on historical applications of MYP throughout the Defense Department over the 1962-1981 time frame. This period was selected by DSMC because it covers the initial years of MYP usage (1962-1971) and a time period during which MYP was restricted by legislative initiatives (1972-1981). FY82 MYP efforts have not been addressed since the results of their successes and failures have not yet been realized.

To further guide the research, emphasis has been placed on "major" weapon systems as opposed to supplies and services. For example, MYPs are commonly used for the acquisition of routine supplies with continuing and stable requirements, e.g., generators, folding chairs, fuel oil. MYPs are likewise used for operations and maintenance services both domestically and overseas in support of U.S. bases. These generally small dollar value MYPs have been deleted from the study as their applicability to the acquisition of complex weapon systems is doubtful, especially with regard to their cancellation.

As used here, "major" system has been loosely applied as opposed to the more stringent guidelines of DoD Directive 5000.1. If the 5000 series instructions were used (even as they have changed over time), only three or four systems would have qualified as "major" in terms of RDT&E and procurement spending thresholds. For study purposes, "major" system includes production contracts of \$10M or more. The majority of the contracts eventually selected have values exceeding \$100M. It is believed that the selected data base is applicable to making forecasts about the increased implementation of MYP in today's defense environment.

Among the "demographic" statistics to have been collected on MYP contracts, special emphasis was placed on documenting savings, cancellation experience, and funding policy for cancellation ceilings. To round out the descriptive MYP contract information, data were collected on: contract numbers, periods of performance, unit prices, system quantities, contract modifications, claims payments, and annual funding levels. This listing reflects the scope of data required to reasonably assess the degree of success associated with past MYPs.

Two other issues were to be addressed in undertaking this research - identify the impact of economic period conditions on MYP, especially today's economic environment; assess how different commodity groups (industries)

exhibited different characteristics for MYPs in those commodity groups. The thrust of the evaluation of economic period conditions is to determine what impact rising and shrinking DoD budgets would have on the use of MYP both from a government and a contractor perspective. The goal of the commodity group analysis is to identify significant differences in the MYPs of various commodity groups, e.g., cancellation ceiling as a percentage of total contract, frequency of cancellation, funding policy.

2. RESEARCH FRAMEWORK

As described in the contract Statement of Work, the research is segmented into two phases. Phase I, as described below, extended from August 1982 to December 1982. Phase II, which represents a more thorough evaluation of Phase I data, and uses the same tasks as shown below, will extend from January 1983 to July 1983. Phase I efforts consisted of five subtasks which were to be undertaken in performing the research. As each subtask was completed in Phase I, the results of that subtask were documented in a report and submitted to the DSMC Contracting Officer's Representative (COR). Table II-1 summarizes the five subtasks which guided this effort. This report reflects the initial findings of the research (Phase I). Based upon DSMC's review of this preliminary data, a second phase of the study will be undertaken to flesh out data in support of the models discussed here.

TABLE II-1
SPECIFIC SOW TASKS

Task A

The contractor shall prepare a detailed plan for achieving the research objective. The plan shall include a schedule for completion of each of the remaining tasks. The contractor's continuation of the effort is contingent on the Government's approval of the implementation plan.

Task B

The contractor will identify the specific documents and other information sources he will use and the kind of information he will need from them to accomplish the stated objectives.

Task C

The contractor shall lay the groundwork for the study by:

- (a) identifying MYP categories in major and nonmajor systems
- (b) identifying criteria for selecting samples of past procurements related to each category
- (c) identifying procedures for filtering out those systems that do not match the current MYP criteria
- (d) identifying the appropriate DoD elements for coordination in performing subtasks (a), (b), and (c) above
- (e) coordinating with the elements identified in subtask (d) above.

Task D

For the systems selected by the procedure described in Task C, the contractor shall gather and analyze the data by:

- (a) determining the past (i.e., historical) percentage of cancellations/terminations associated with each category and during each economic period
- (b) determining the magnitude and percentage of cancellation fees associated with recurring and nonrecurring costs in each category during each economic period
- (c) projecting how the above (historical) cancellations/terminations would have been affected by an economic environment such as currently exists.

Task E

The contractor shall:

- (a) develop a methodology for adjusting the magnitude of the cancellation ceiling (as a percentage of the total value of the contract) in each category and during each economic period
- (b) develop a formula and/or methodology for determining the value of partial coverage for the cancellation ceiling in each category and during each economic period
- (c) Compare the advantages and disadvantages of operating under the methodology of (b) above vice under the existing practice of fully funding the cancellation ceiling--particularly as it relates to a major system acquisition
- (d) develop the methodology for determining the "cross-over" point--the point in time (beyond the initiation of a contract) when the savings that would be accrued to the government as a result of implementing an MYP (vice Annual Year Procurement) would be equal to or greater than the loss that would be incurred by the Government if the (MYP) were cancelled at any time beyond this point.

3. MULTIYEAR PROCUREMENT EVOLUTION

As noted earlier, this research addresses the twenty-year time frame, 1962-1981, during which time MYP has experienced important gains and losses in favor within DoD, the Congress, the General Accounting Office (GAO), the Office of Management and Budget (OMB), the acquisition community, and the defense industry. This abbreviated discussion of the evolution of MYP serves to set the stage for this study in terms of providing actual data with which to evaluate past successes and failures.

MYP originated during 1961-1962 in the Department of the Army with the acquisition of five-ton trucks and standard engines. It was during this time that the Defense Acquisition Regulations (DAR) were to formally adopt guidelines for MYP. The DAR wording imposed MYP criteria nearly identical to those promulgated recently by Mr. Carlucci. During this early time (1961-1966), MYP was used regularly by the Services for standard supplies and services with good success both in the areas of savings and low frequency of cancellation although MYP contracts were a relatively small portion of procurement transactions.

The latter part of the 1960s saw the leveling off of MYP usage with a few notable exceptions in the Navy shipbuilding community. During this time, there was a decided thrust to expand MYP from minor supplies and services to larger dollar value systems. To accomplish this transition, several legislative "attitudes" were changed regarding full funding and the allowable composition of the cancellation ceiling.

During the late 1960s, the Navy's use of MYP as part of a Total Package Procurement (TPP) initiative for the DD-963 and LHA-1 class vessels marked a major turning point in the use of MYP as a contracting vehicle. These \$1B plus acquisitions were marked by continuing claims and counterclaims over Navy change orders. As a result of the disagreements between Navy and contractor officials over late deliveries, unit price changes, and other weighty matters, the Navy cancelled the LHA contract, forcing Congress to pay a \$109.7M cancellation fee in 1972, the largest ever paid on an MYP contract. Congress, not fully realizing the ramifications of the Navy's MYP forays with regard to the LHA and DD-963, reacted strongly and negatively to the cancellation payment. During the next session, Congress amended the law in 1973 and placed a \$5M limitation on cancellation ceilings.

The ensuing ten-year period saw a decline in the use of MYP, but not the elimination of MYP as might have been expected. While MYP was used for supplies and services much as before, it was used, on a limited basis, for other relatively large dollar value systems. In the mid-1970s, Congress modified its 1973 legislation to permit waivers, on a case-by-case basis, for MYPs with cancellation exceeding \$5M. At the present time, Congress has enacted legislation increasing the cancellation ceiling to \$100M.

During this historical period, numerous controversies over MYP have arisen. The Carlucci initiatives welcomed in a new era in defense acquisition, with MYP as one of the bulwarks of the AIP. However, certain important controversies still exist in the areas of MYP savings, adjustment of the cancellation ceiling, and most prominently, cancellation ceiling funding policy. Congressional, OMB, and DoD policy stipulates the "full funding" of MYPs (see Appendix C for a definition of MYP terms).^{1,2} The present environment regarding MYP funding is somewhat confused by existing guidance documents which have been interpreted in various ways by contracting officers, program managers, comptrollers, etc. DoD acquisition managers, contracting officers, and certain OSD officials believe that partial funding of MYPs is a more realistic means of covering cancellation ceilings. This single most important controversy of MYP has blocked wider adoption of MYP, and is at the heart of this research effort.³

III. TECHNICAL APPROACH

III. TECHNICAL APPROACH

This chapter describes the research methodology, provides raw data on past MYP applications, and discusses how those data are analyzed to address the primary study objectives. The first section defines MYP, compares it to the traditional acquisition process, and identifies the criteria established by DoD for use of an MYP vehicle. Data collection efforts and a listing of applicable commodity (industry) groups are discussed in the second section. In the third section, collected data are presented and summarized for approximately 40 past MYP applications. A discussion of the estimated savings attributable to past MYPs is followed by a review of the MYP funding approaches used in past contracts. In the final section, methods for adjusting the cancellation ceiling are described along with a discussion of the relation between MYP savings and the potential loss to the government due to cancellation.

1. MYP TERMINOLOGY

In addition to the MYP definitions provided in Appendix C, a brief comparison of MYP and Annual Year Procurement (AYP) is shown in the following pages. Weapon system acquisitions traditionally have been carried out using a series of annual (one year) contracts for which Congress would authorize and appropriate funds one year at a time. As threats, requirements and Congressional interests changed, weapon system acquisitions could be modified each year (terminated, accelerated, slipped, etc.) as necessary. While providing flexibility to DoD and Congress, there were inherent inefficiencies in this traditional approach. Because contractors were unsure of the next year's funding, they were reluctant to make larger, more efficient buys of both nonrecurring capital goods and recurring material to support the production. In the AYP case, should Congress terminate a major system production, no liabilities exist other than explicitly funded under the last AYP contract.

An MYP contract, by comparison, may extend for two to five years vice the one year for an AYP. Each annual increment of an MYP still requires Congressional approval; however, the funding structure of an MYP is vastly different than that of an AYP. Under MYP, the government may create contingent liabilities to cover the MYP contractor in the event the government cancels the MYP contract at any point during its execution. These liabilities arise to the extent nonrecurring and recurring costs are incurred (during a contract's early years) by the contractor in the government's behalf to reduce the overall cost of a weapon acquisition. Only to the extent the possibility of and necessity for MYP cancellation exists, is there a problem regarding these liabilities because costs are fully amortized when the contract goes to term. Table III-1 summarizes some of the important differences between MYP contracts and AYP contracts.

This deliberately simplistic overview of the differences in MYP and AYP contracts serves to highlight the most controversial areas of the MYP issue. Funding profiles for MYPs and AYPs are considerably different in that MYPs create large front end costs but lower overall costs. Congressional and DoD flexibility is greater in the AYP case as the impact of a termination will be less than that of an early MYP cancellation. The

TABLE III-1 MYP AND AYP CONTRACT CHARACTERISTICS

<u>Characteristics</u>	<u>MYP</u>	<u>AYP</u>
Selection Criteria	Specific MY criteria	No set guidance
Contractual Reqts.	2-5 Years	1 year
Commodities Procured	No restrictions	No restrictions
Contractual Liabilities	Cancellation	Termination
Costs if Contractor cancelled/terminated	Potentially large cost	Low cost
Limits on Dollar Threshold	None	None
Funding Approach	Must be allocated each year	Must be allocated each year
Cost Spread Over Time	Large front end costs; lower overall costs	Lower front end costs; higher overall costs

funding approach taken by the government (full vs. partial) determines the degree to which cancellation fees become a problem because of the potential mismatching of the expenditure and funding profiles. Last, the government's direction and disposition as to the nature of the economic order quantity (EOQ) buys of material, parts, components, assemblies, etc., supporting the MYP directly impact the potential cancellation ceiling. These and other key issues are discussed in the remainder of this chapter.

The remaining definitional area for understanding MYP relates to the criteria for selection of an acquisition as an MYP candidate. These criteria, as paraphrased below, were specified by Mr. Carlucci in his 1 May 1981 policy memorandum on MYP. To be an MYP candidate, the weapon system must include cost avoidance weighed against five risk factors:

- degree of confidence in the estimated cost avoidance
- degree of confidence in the contractor's ability to perform the MYP
- stability of the system requirements for the term of the MYP
- stability of the system funding
- stability of the system configuration and underlying design.

The applicability of these criteria to the various new weapon systems facing production varies considerably. The intuitive appeal of cost savings from MYP on all acquisitions is balanced by the loss of managerial flexibility and the real world knowledge that weapon system requirements change rapidly in the face of changes in the perceived threat, and to a lesser degree, in the technological environment existing today. Nonetheless, to the extent a new or existing weapon system meets these criteria, it may be an acceptable MYP candidate.

With this background information aside, the remainder of the chapter focuses on data collection and analysis performed to support this research.

2. MYP DATA COLLECTION

This section identifies the specific data collection approach and the commodity groups of interest.

1) MYP Contract Data Sources

In pursuit of the research objectives noted in chapter I, INTRODUCTION, a structured data collection process was undertaken drawing both from the existing MYP literature base and the substantial number of individuals close to the topic. Approximately forty reports and hundreds of pages of Congressional testimony were identified, collected, reviewed, and analyzed for applicability to the study. Appendix A, a bibliography, enumerates the reports used to provide data and data leads for the research. It should be recognized that these sources, in some cases, go back nearly twenty years for some MYPs. While they provide excellent background material, they were normally used to identify specific individuals and/or organizations for details of specific MYP contracts.

Of greater importance, approximately 50 personal and telephone interviews were accomplished within:

- . House Appropriations Committee (HAC)
- . Congressional Budget Office (CBO)
- . OSD
- . GAO
- . Services (Army, Navy, Air Force, Marine Corps)
- . Defense agencies
- . Civilian departments (Coast Guard, Maritime Administration)
- . Commercial firms.

The interviews included; contracting officers, program managers, comptrollers, acquisition policy analysts, and service MYP representatives. The primary thrust of the interviews was to identify and make available specific data on past MYP efforts in the areas of savings, cancellations and funding. Appendix B provides a listing of the specific organizations with which interviews were conducted. It also contains a summary of a discussion with HAC members on MYP.

The interview process was initiated in a "top down" fashion starting within OSD in the hope that a centralized data base of MYP contractual information would exist. To the extent that it did not exist at OSD, it was recognized that a broader-based interview process within the Services would be required at the system command or system project office (SPO) level. No documented MYP data base exists at OSD; however, a centralized contract data base does exist utilizing DD Form 350, entitled, Individual Procurement Action Report, as its source document. Figure III-1 shows the DD Form 350 with the applicable data fields of interest highlighted. The OSD Washington Headquarters Services (WHS) was requested by DSMC to provide specific MYP contractual statistics from their data base back to 1966, the date from which this information was first collected. At the time this report was written, sample DD 350 data have been provided from FY 1971 to permit an evaluation of its utility. While preliminary inspection of these data indicates important errors, the data have not been tested fully to determine the usefulness of this centralized repository.

One important aspect of the data collection effort involved contact with the Harvard University Kennedy School of Government, where David Whitman, Research Coordinator for the School's Institute of Politics has written several case studies on MYP. This individual provided important data on past MYP applications that were most useful to this research. While the focus of the Harvard case study was not identical nor as focused on specific contractual information, in many instances, useable raw data and valuable data leads were provided.⁴

2) Economic Data

Data were collected on the economic conditions (i.e., gross national product, and defense expenditures) for a twenty year period. Historical economic data were derived from the following sources:

FIGURE III-1 SAMPLE FORM DD 350

INDIVIDUAL PROCUREMENT ACTION REPORT										RFS OR DRAFT NO.	
1A REPORT NO (Current)		1B (Reserved)		1C REPORT NO (Previous)		2 CONTRACT NO		3 (1) ACTIVITY		3 (2) FY	
						A Defense B Other				3 (3) Small No	
Item 3 Code	4 CORRECTION OF PRIOR DD FORM 350 1 Corrected entry 2 Reversing entry										
Item 4 Code	5 PURCHASING OFFICE										
Item 5A Code	5A SMALL DISADVANTAGED BUSINESS CONCERN A Yes B No known source C Not Solicited D Solicited but did not bid E Not solicited for other reasons										
Item 5 Code	6 CONTRACTOR IDENTIFICATION Company Name: _____ Item 5A Code: _____ DUNS No: _____										
Item 7 Code	City State		7 PRINCIPAL PLACE OF PERFORMANCE (City and State or Country)					7A (Reserved)		7B (Reserved)	
Item 7C Code	7C MULTI-YEAR PROCUREMENT A Multi-year procurement B (Reserved Do not use) C Not a multi-year procurement										
Item 8 Code	8 SUBJECT TO STATUTORY REQUIREMENTS A Walsh Healey Act, Manufacture B Walsh Healey Act, Regular Dealer C Service Contract: Art D Service Contract: Equip E Service Contract: Other										
Item 9 Code	9 LABOR SURPLUS AREA PREFERENCE 1 (Reserved Do not use) 2 Partial Labor Surplus Area Set-Aside Preference 3 Labor Surplus Area Tie-Bid Preference 4 (Reserved Do not use) 5 Not a Labor Surplus Area Preference Award 6 Combined Small Business/Partial Labor Surplus Area Set-Aside Preference 7 Total Labor Surplus/Small Business Set-Aside Preference 8 Total Labor Surplus Area Set-Aside Preference										
Item 10 Code	10 AFFIRMATIVE ACTION PLAN 10A On File 1 Yes 2 No 3 Example 10B On Premises With Contractors 1 Yes 2 No 3 Example 10C DD CLAIMANT PROC NO 11 DESCRIPTION OF COMMODITY OR SERVICE										
Item 12 Code	12 COORDINATED PROCUREMENT 1 Procurement Agreement 2 Other Federal Agency 3 GSA Supply Schedule 4 Small Business Admin (SBA) 5 Single Department Procurement 6 Defense Logistics Agency 7 Defense U.S. 8 Other										
Item 13 Code	13 SYNOPSIS OF PROPOSED PROCUREMENT A Synopsized B Not Synopsized Original Estimate under \$10,000 C Not Synopsized and Exception 1 2 3 4 5 6 7 8 9										
Item 14 Code	14 KIND OF PROCUREMENT ACTION 1 Initial Letter Contract 2 Definitive Contract (including Letter Contract) 3 Definitive Contract (including Letter of Award) 4 Order under Contract 5 (Reserved Do not use) 6 Acquisition with 7 Contract Order 8 Termination or Renewal Order										
Item 15 Code	15 CONTRACT PLACEMENT 1 Informal advertisement (Do not fill in items 16 thru 22) 2 Two-day formal advertisement (Do not fill in items 17 thru 19A) 3 Other formal advertisement (Do not fill in items 17 thru 19A) 4 Small Business restricted advertising (Fill in all items) 5 Other restricted (Fill in all items) 6 Order Total Small Business Set-Aside (Fill in all items) 7 Foreign Military Sales (Do not fill in items 16 thru 22)										
Item 16 Code	16 TYPE OF BUSINESS CONCERN Assigned to Large Business A Not solicited B Solicited but did not bid C Bid was not firm D Bid not accepted for other reasons Assigned to Small Business L Assigned for work outside U.S. and possessions Assigned to Minority Institutions 1 Nonprofit Educational 2 Nonprofit Hospital 3 Nonprofit Other B Assigned to Contract Firm for work in U.S.										
Item 17 Code	17 NEGOTIATED UNDER 19 USC 2805(a) EXCEPTION For 19 USC 2805(a) Exception 1A Labor Surplus Area or industry award 1B Unaffiliated Small Business award 1C Domestic Area award 1D Balance of Payments Program Regulation accomplished pursuant to 19 USC 2805(a) Exception No. 10-1 10-2 10-3 10-4 10-5 10-6 10-7 10-8 10-9 10-10 10-11 10-12 10-13 10-14 10-15 10-16 10-17 10-18 10-19 10-20 Otherwise authorized by law 17A Joint Small Business award 17B Other (Specify): _____										
Item 18 Code	18 EXTENT OF COMPETITION IN NEGOTIATION 1 Full competition 2 Open bids 3 Design bids 4 Follow-on after price award 5 Follow-on after design/technical award 6 Other non-competitive 7 Exclusive or limited bids Not Applicable 1 Monopsony										
Item 19 Code	19 CERTIFIED COST OR PRICING DATA (This action only) A Required B Not Required										
Item 19A Code	19A COST ACCOUNTING STANDARDS CLAUSE 1 Includes or is subject to clause 2 Does not include or is not subject to clause										
Item 20 Code	20 TYPE OF CONTRACT Fixed Price Non-Competitive A Type A 1 Item fixed price 2 Item fixed price economic price adjustment 3 Type B 1 Item fixed price 2 Item fixed price economic price adjustment Fixed Price Competitive 1 With performance incentive 2 Without performance incentive 3 Without performance incentive Cost Plus Award Fee 1 With performance incentive 2 Without performance incentive 3 Without performance incentive Cost Plus Fixed Fee 1 With performance incentive 2 Without performance incentive 3 Without performance incentive Time and Materials 1 Labor hour 2 Labor hour plus material										
Item 21 Code	21 SUBCONTRACTING PROGRAM PLAN CLAUSE 1 No clause and interpretation includes only necessary subcontract 2 Both negotiated and non-negotiable (Specify) 3 Buy American Act (Specify)										
Item 22 Code	22 TRADE DATA A No of orders allowing foreign and items B Percent of foreign content C Buy American Act Percent Allowance										
Item 23 Code	23 DUTY FREE ENTRY ENTITLED 1 Yes 2 No										
Item 24 Code	24 DATE OF THIS ACTION A Year Month Day		25 ESTIMATED COMPLETION DATE Year Month		26 TOTAL OF THIS ACTION (Round to nearest whole dollar)		27 (Reserved)				
28 TYPED NAME AND SIGNATURE OF CONTRACTING OFFICER OR REPRESENTATIVE						29 TEL. AREA		30 DATE SUBMITTED			

DD FORM 350 OCT 1963

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

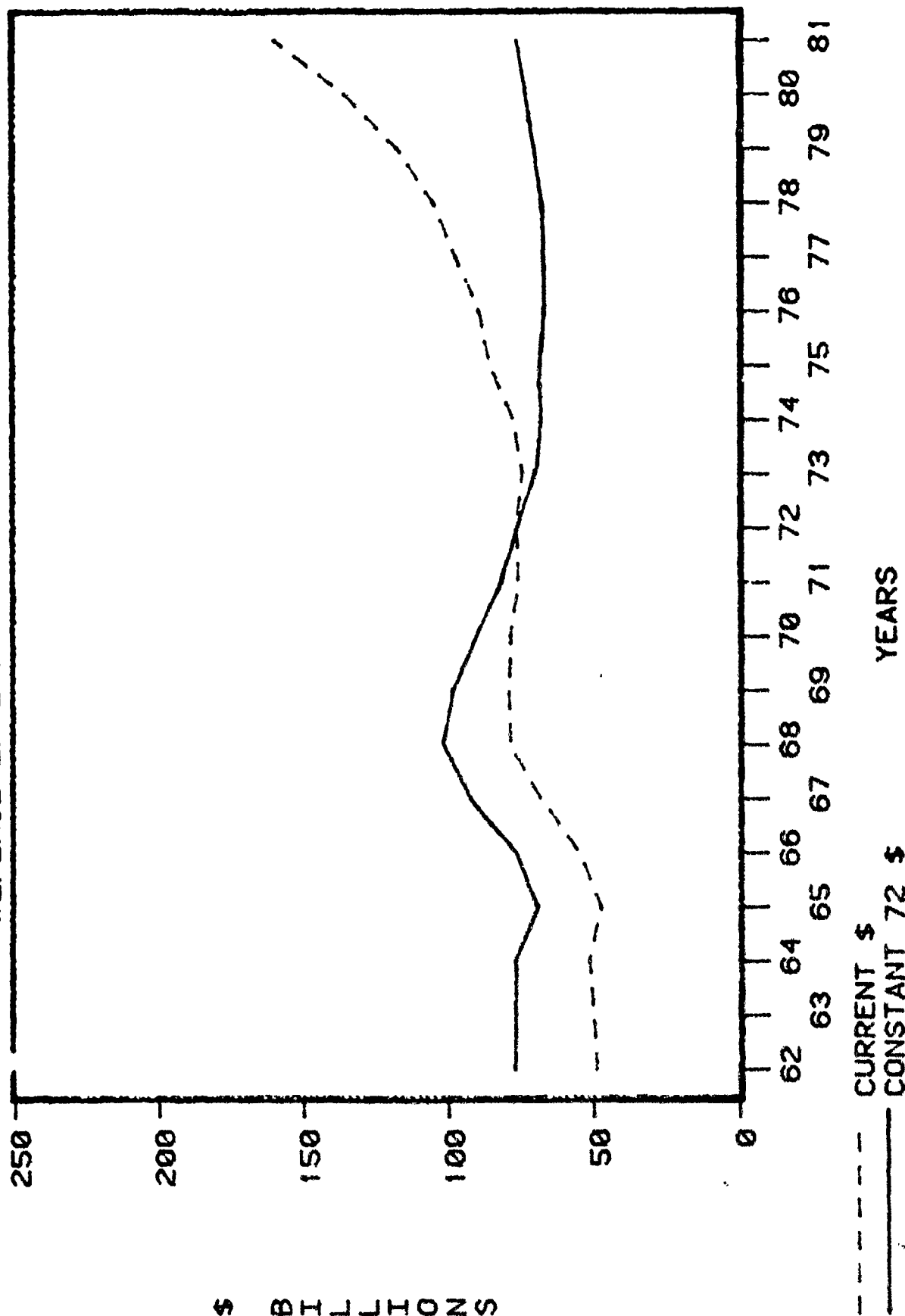
- Economic Report of the President
- Survey of Current Business, Department of Commerce,
Bureau of Economic Analysis
- Recessions and Forecasts, National Bureau of Economic
Research
- National Defense Budget Estimates, Office of Assistant
Secretary of Defense (Comptroller).

These sources were reviewed to develop a picture of overall national economic health as well as the health of the defense industry.

Figure III-2 shows Defense Expenditures in both current and constant year dollars for the 1962-82 timeframe. It is interesting to note that, with the exception of the Vietnam War period (1964-1969), defense expenditures in constant terms have been relatively stable with a slight increase in the late 1970's. Figure III-3 shows National Defense as a Percentage of Gross National Product between 1962 and 1982. As shown in this figure, the National Defense percentage of GNP has been on a relative decline since the 1970s, and has only begun to pick up since the early 1980s. The National Bureau of Economic Research literature provided the guidance for defining the recessionary trends over the last 20 years. Figure III-3 indicates that the percentage of GNP related to National Defense does not appear to be particularly sensitive to recessionary economic periods. There is also no significant relation between the number of MYP contracts and defense expenditures or recessionary conditions. Figure III-3 shows that the number of MYP contracts is distributed randomly over the twenty year period. Moreover, there are no evident conclusions to be drawn on economic conditions or defense spending relative to MYP experience.

The majority of interview respondents were asked about the impact of economic conditions on MYP. Their responses and the review of the collected MYP data reveal no discriminatory factors bearing on the frequency or degree of success of MYP under various economic period conditions. Certain respondents indicated that prime contractors would be willing to enter into MYPs both in recessionary times to improve business bases and during expansionary times to further solidify those bases. These same discussions indicate that of more importance to a contractor is the health of his particular industry as well as the degree to which his risks are covered when entering an MYP contract. For example, certain major contractors have indicated that in an economic environment like the present (poor overall economic activity, high interest rates, high levels of defense spending), MYP is attractive to commercial firms to the extent their financial risks are covered by adequate funding, i.e., they are unwilling to finance large nonrecurring and EOQ material buys by borrowing without; cancellation coverage, advance progress payments, or allowing the cost of money as a reimbursable cost. After reviewing the limited information available, it becomes clear that the specific commodity/industry economic conditions are much more important to MYP implementation than general or defense-wide economic conditions.

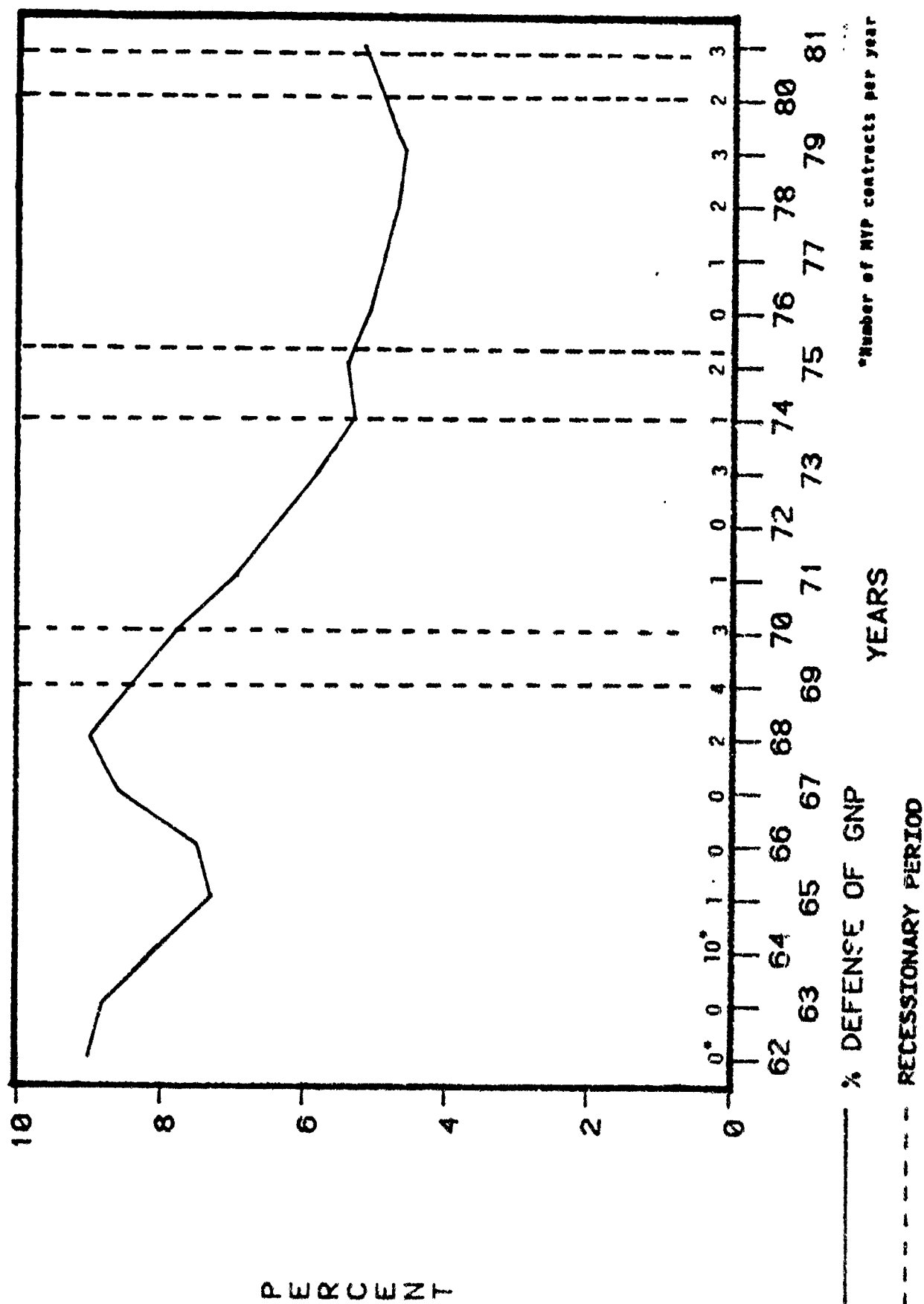
FIGURE III-2
DEFENSE EXPENDITURES SINCE 1962



\$ BILLIONS

FIGURE III-3

NATIONAL DEFENSE AS A PERCENT OF GNP



A statistical model was formulated to test the hypothesis that the occurrence of an MYP contract cancellation is, in some manner, a function of the relative "health" of the defense sector of the economy. Various measures were constructed in order to represent the overall economic condition of the defense sector. The most promising measure was the ratio of defense expenditures to Gross National Product. The statistical analysis consisted of a postulated regression analysis equation of the form:

$$C_i = a + b (DEF/GNP)_i$$

where $(DEF/GNP)_i$ represents the ratio of defense expenditures to GNP in the final year of the i th MYP contract, and C_i is a binary variable such that

$$C_i = \begin{cases} 1 & \text{if the } i\text{th MYP contract is cancelled} \\ 0 & \text{otherwise.} \end{cases}$$

Drawing from the data presented in Table III-3, the model shown above was estimated. The results indicate that there is no statistically significant relationship between the explanatory variable $(DEF/GNP)_i$ and the occurrence of contract cancellation.

Similarly, the model was tested using a different set of explanatory variables that attempted to explain MYP contract cancellations as a function of various attributes of the contract. For example, total contract size was tested under the hypothesis that the larger the size (in dollar value) the higher the probability of cancellation. Other such explanatory variables tested included: the total quantity purchased, the average unit price, and the length of the contract. All the explanatory variables proved to be not statistically significant.

3) MYP Commodity/Industry Groups. Weapon system acquisitions differ considerably across many parameters, including:

- . system quantities
- . production rate
- . production duration
- . unit and total cost
- . nonrecurring cost requirements
- . labor/material mix.

As a result of these and other differences, it was recognized that MYPs would have been and should continue to be structured differently for the respective commodity groups. MYP has been used across a wide range of defense commodity groups, including:

- . ships
- . fixed-wing aircraft/helicopters
- . tanks/tracked vehicles
- . electronics/communications
- . missiles
- . torpedoes.

At this time, no data are available to show the use of MYP for satellite systems. This is probably due to both the limited number of common satellites procured at any one time and the instability of design requirements.

Table III-2, shows the kinds of systems within commodity groups to which MYP has been applied. The majority of MYP uses, as shown, have been in ships and electronic systems. The forty-two MYPs on which data have been collected were distributed unevenly across these commodity groups.

TABLE III-2 MYP APPLICATIONS BY COMMODITY GROUP

<u>SHIPS</u>	<u>ELECTRONICS</u>	<u>TRACKED VEHICLES</u>	<u>MISSILES/ TORPEDOES</u>	<u>AIRCRAFT</u>
- Combatants	- Radar	- Trucks	- Missiles	- Helicopters
- Amphibious	- Sonar	- Howitzers	- Launchers	- Reconnaissance
- Submarines	- EW	- Engines	- Torpedoes	
- USCG Cutters	- Radios			
- MARAD Tankers	- Avionics			

Ship and electronic systems have accounted for approximately 37% and 26%, respectively, of the total number of identified MYPs, with the remaining, 37% unevenly divided across the remaining commodity groups. MYP has not been applied to aircraft platforms on any regular basis, with the exception of the Navy's RA-5C (more a hybrid option contract than an MYP) and the Coast Guard's helicopters. Interestingly enough, the Army, Navy and Coast Guard have used MYP more extensively than the Air Force for "major" systems in the period of study. This does not reflect the Air Force's recent MYP effort for the F-16.

With this overview of MYP contracts proper, data collection approaches, methods and issues, and an identification of the respective MYP commodity/industry groups, actual data are provided and analyzed in the following sections.

3. MYP ACTUARIAL TABLE DEVELOPMENT

As just described, MYP contract characteristics data have been collected for forty-two systems. Due to the historical nature of many of these acquisitions, only incomplete data elements are available at this time for certain of the systems. In particular, the specific annual cancellation ceilings and the funding approach for each contract are not known in all instances. Table III-3 presents a master list of systems with the following MYP characteristics:

- . System name
- . Contract number
- . System unit costs

TABLE III-3

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS
<u>COMMUNICATIONS/ELECTRONICS</u>								
AN/SLQ-32	N-00039-77-C-0132	\$ 299,295.13 \$ 534,676.47 \$1,504,000.80	\$ 32,024,579.00 60,418,441.00 96,260,275.00 \$188,703,295.00	107 113 64 284	FY-77 FY-78 FY-79	Yr. 1 - \$5.0M (26.5%) Yr. 2 - \$3.0M (15%)	Not funded	- High confidence in costs due to strict OIC program - Avoid CXL ceiling - No CXL to contract - If work had been stopped, mat'l goes to spares
AN/ALQ-155	F-33657-79-C-0833	\$ 360,056.00	\$22.0M \$22.5M \$ 9.7M \$54.2M	61 63 50 174	FY-80 FY-81 FY-82	Yr. 1 - \$4.75M (9%) Yr. 2 - \$4.17M (8%)	Not fully funded	- Material buy-out by FY-80. - Lots 1 and 2 bought AYP at \$57M (not shown)
AN/WSC-3	N00039-79-C-00261	\$24,192.54	\$ 6,870,681.36 4,838,508.00 12,652,698.42 10,572,139.98 7,427,109.78 \$42,361,137.54 \$59,288,867.00 \$101,650,004.54	284 200 523 437 307 1,751 OTHER	FY-80 FY-81 FY-82 FY-83 FY-84	Yr. 1 - \$5.0M (11%) Yr. 2 - \$4.75M (11%) Yr. 3 - \$2.0M (5%) Yr. 4 - \$0.5M (1%)	Not funded	\$42,361,137.54 for Basic Yearly Buys vs. \$101,660,002 for total contract. Total contract has over 30 options that have been and will continue to be exercised.
AN/TPS-59	N-00039-80-C-0482	--	- - \$15M	5 6 4 15	FY-81 FY-82 FY-83	Yr 1 - \$4.80M (3%) Yr 2 - \$4.02M (3%)	Not funded	HQ USMC is aware of the cancellation ceiling amounts, and should the need arise, these funds would be made available from a previous year's appropriation.
AN/PAC-25	Unknown	\$604.00	\$9.45M	16,482	FY-84-86	Unknown	Unknown	N/A

TABLE III-3 (CONT'D)

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS
MRC-1/R-1051	Unknown	Unknown	\$17,805,355.00	--	FY-65	Unknown	Unknown	- 3 yr contract w/Bendix
AN/ARC-54	Unknown	\$1.361	\$6.215M	4,500	FY-64-66	Unknown	Unknown	N/A
AN/SQJ-23	MD0024-79-C-6023	Unknown	---	2	FY-79	Yr. 1 - Unknown	Not funded	- Cancellation ceiling was established as a percentage of contract value, i.e., 4.1% in year 2.
			---	4	FY-80	Yr. 2 - \$1.4M (4%)		
			---	2	FY-81			
			\$34.4M	8				
AN/SQS-23	MD0024-71-C-1243	\$4.0M (up from \$770,000 original)	\$11.6M	3	FY-71	Yr. 1 - 12% (\$1.39M)		- 5 yr. program with 3 production contract
			\$39.4M	16	FY-72	Yr. 2 - 9% (\$3.55M)	Cancelled	- Production of 64 units had total value of \$60.254M.
			\$24.0M	18	FY-73	Yr. 3 - 6% (\$1.44M)	for	
			---	--	FY-74	Yr. 4 - 3%	\$3.493M	
			\$75.0M	37				
AN/BQJ-5	Unknown	Unknown	Unknown			Unknown	Unknown	- Letter request from USMC to NAVSEA for data- awaiting responses
AN/SLQ-25	MD0024-82-C-6080	\$169,393	\$10.4M	18	FY-81	Yr. 1 - 15% (\$1.6M)	Fully	
				13	FY-82	Yr. 2 - 5% (\$0.5M)	Funded	
				26	FY-83			
				57				

TABLE III-3 (CONT'D)

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS
<u>TRUCKS/VEHICLES</u>								
1/4 Ton Truck (M-151-A1)	Unknown	\$2,035K	\$22.9M	--	FY-64-65	Unknown	Unknown	
2 1/2 Ton Truck (M-44 Series APT)	Unknown	Extra 2,000 units @ \$11,893,182	\$164,194,974	27,325 2,000 29,325	FY-64-66	Unknown	Unknown	
Engines (LSD-465)	Unknown	Extra 2,000 units @ \$3,734,800	\$53,458,349	28,056 2,000 30,056	FY-64-66	Unknown	Unknown	Further cancellation data have been requested for these old Army contracts
5 Ton Truck	Unknown	Unknown	Unknown	8,393	FY-64-66	Unknown	Unknown	
Engines (LSD-465)	Unknown	Unknown	Unknown	10,028	FY-64-66	Unknown	Unknown	
<u>TANKS/TRACKED VEHICLES</u>								
M-109 Howitzer 155M	Unknown	\$45,800	\$46.991M	1,026	FY-64-66	Unknown	Unknown	
M-110 Howitzer	Unknown	\$43,357	\$13.484M	311	FY-64-66	Unknown	Unknown	
M-113	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Data search being conducted by U.S. Army Tank Automotive Command
General Purpose Vehicle	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	
<u>SUBMARINES</u>								
SSN-688	M00024-71-C-0270	\$61.9M	--	1	FY-70	Yr. 1 - \$7.7M (3%)		- General Dynamics first SSN -688 2 yrs. late
		--	--	2	FY-71	Yr. 2 - \$5.1M (2%)	No	
		--	\$293.7M	1				
		--	--	2				
		--	\$412.9M	4				
		--	--	7				
	M00024-71-C-0268	\$60.9M	--	1	FY-70	Yr. 1 - \$20.6M (5%)		- \$359M in claims paid on SSN-688 vs. \$853M requested by shipbuilders
		--	--	2	FY-71	Yr. 2 - \$21.7M (5%)		
		--	--	4	FY-72			
		--	--	7				

TABLE III-3 (CONT'D)

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS		
<u>AIRCRAFT</u>										
RA-5C	N00019-68-C-0190	\$45.7M	\$ 548.4M	12	FY-69	Yr. 1 - Unknown	Not funded	- Not strictly an MYP contract; unusual options		
		\$72.0M	\$1728.0M	24	FY-70	Yr. 2 - Unknown			Not funded \$15.3M fee paid	- 1st two lots bought; - FY-71 lot cancelled and treated as spares
		--	--	--	--	--				
		\$117.7M	\$2276.4M	36	--	--			--	
<u>HELICOPTERS</u>										
USGG	D0006 - 80513-A	Unknown	\$214.8M	90	FY-79	Yr. 1 - \$55.8M (26%)	Not funded	- 5 year MYP still in process - No anticipated cancellation		
					FY-80	Yr. 2 - \$43.0M (20%)			Not funded	
					FY-81	Yr. 3 - \$34.3M (16%)				
					FY-82	Yr. 4 - \$12.9M (6%)				
<u>SHIPS</u>										
DE-1052	N00024-64-C-4782 N00024-64-C-4783 N00024-64-C-4784 N00024-64-C-4785	Unknown	Unknown	7 7 7 5 26	FY64	Todd Seattle	N/A	- \$292.6M claims paid for 46 ships (DE-1052 and DE-1078) - 1st DE-1052 20 months late - Contracts fully funded each year so no ceilings were created		
					FY64	Todd LA				
					FY64	Avondale				
					FY64	Lockheed				
DE-1078	Unknown	Unknown	Unknown	20	FY66 Avondale		Unknown	- Claims related to design/drawing changes, GFE deliverables, etc.		
LHA-15	Unknown	--	--	--	FY69	Yr. 1	\$109.7M	- Total package procurement - CXL for 4 ships, escalation, delays, changes to contract caused renegotiation of prices - \$109.7M cancellation fee paid - \$332M actual unit price for 5 delivered ships		
					FY70	Yr. 2				
					FY71	Yr. 3 - Unknown				
					FY72	Yr. 4 - Unknown				
					FY73	Yr. 5 - Unknown				
					FY73					
T-AGOS	N00024-80-C-2046	\$12.1M	--	3 5 4 12	FY79/80	\$3.9M (2.5%)		- FY79 and FY80 contracts awarded together - FFP Contract - Ceilings were established as percentages of contract value, i.e., 2.48% and 1.98%		
					FY81	\$3.1M (2.0%)				
					FY82	--				
					FY82H					

TABLE III-3 (CONT'D)

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS
UD-963	Unknown	--	--		FY70-71			
		--	--		FY72	\$335.0M for 10-30 units	- Total package procurement (TPP)	
		--	--		FY73	\$279.1M for 17-30 units	- \$138M actual unit price for 30 delivered ships	
		--	--		FY74	\$171.8M for 24-30 units		
		\$138.0M	\$4,140.0M	30				
LST	N0024-67-C-0206	\$14,653,588 initial \$18,846,634 with change order	\$320,392,772 including change order	17	FY-69-72	Unknown	- Change order was funded - No cancellations - Change order funded \$47,302,353 +23,979,423 escalation \$71,281,776	
USCG Cutters	DOTCG 2381-C-30026	Unknown	\$349.5M	9	FY-81 FY-82 FY-83 FY-84	Yr. 1 - \$28.0M (8%) Yr. 2 - \$28.0M (8%) Yr. 3 - \$21.0M (6%)	- 4 year MYP still in process - No anticipated cancellation	
USCG Cutters	DOTCG-72509-A	Unknown	\$110.2M	4	FY-78 FY-79	Yr. 1 - \$5.5M (5%)	- 2 year MYP - contract went to term	

TABLE III-3 (CONT'D)

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS
34,000 DWT Tanker	MA/MSB-139	\$19.9M	\$ 59.7M	3	1973	Unknown	No	One of these six contracts was cancelled. MARAD is reviewing their files to determine which was cancelled. No fees were paid. in this one cancellation.
RU/EO Vessel	MA/MSB-142	\$37.8M	\$ 37.8M	1	1973	Unknown	No	
89,000 DWT Tanker	MA/MSB-145	\$27.6M	\$ 55.6M	2	1973	Unknown	No	
89,000 DWT Tanker	MA/MSB-263	\$28.1M	\$ 84.3M	3	1974	Unknown	No	
37,000 DWT Tanker	MA/MSB-289	\$21.6M	\$ 21.6M	1	1975	Unknown	No	
89,000 DWT Tanker	MA/MSB-296	\$32.8M	\$ 32.8M	1	1975	Unknown	No	
TORPEDOES								
MK-46	N00027-69-C-1307	--	\$ 52,179,379	1,500	FY-69	Yr. 1 - 1% (\$1.4M) Yr. 2 - 5% (\$6.77M)	\$950,000	- MYP contract negated in 1970.
		--	\$ 40,186,060	1,200	FY-70			- FY-71 unit costs increased.
		--	\$ 49,984,627	1,500	FY-71			- \$950K fee paid for cancellation
			\$142,350,066					
MK-46 Mod Kits	N00024-78-C-6013	--	--	--	FY-78	Yr. 1 - 3% (\$1.7M) Yr. 2 - 2% (\$1.2M)		- Claims are currently being negotiated on MK-46 Mod Kit
		--	--	--	FY-79			- Cancellation ceilings were established as percentage of contract, i.e., 3% and 2%.
		--	--	--	FY-80			
			\$58.1M	2,706				

TABLE III-3 (CONT'D)

SUMMARY OF MYP DATA

SYSTEM	CONTRACT #	UNIT PRICE	TOTAL PROGRAM \$	QTY	YEARS	CANCELLATION CEILING	CANCELLATION FEES/ FUNDING ARRANGEMENTS	COMMENTS
<u>MISSILES</u>								
TOW	Unknown	Unknown	\$ 11.0M - no production \$ 46.5M \$100.0M \$ 83.3M \$ 62.0M \$ 40.7M \$ 57.9M \$ 79.6M \$481.0M	-- -- -- -- 12,000 18,000 24,000	FY68 FY69 FY70 FY71 FY72 FY73 FY74 FY75	Unknown	- Only production costs for missiles shown - TOW quantities underwent juggling - FY70 completed 2 year MYP contract. - letter request from DSMC to MCOM for data - awaiting response - Congressional ceiling on FY70 TOW program caused lower qty & higher unit cost.	
SHILLELAGH	DAAG01-69-C-0059	\$1,906 \$1,993	\$100.8M \$71.7M \$172.5M	52,903 35,956	FY68 FY69	Yr. 1 - Unknown Yr. 2 - Unknown	\$2.5M	- Shillelagh program cancelled in FY70 at cost of 2.5M.
<u>OTHERS</u>								
General Purpose Bomb (M1-81 Model 1)		Unknown	\$87.37M	Unknown	Unknown	Unknown	Unknown	N/A
Digital Data Computers CP-624-B USQ-20		\$125,000.00	Unknown	Unknown	Unknown	Unknown	Unknown	N/A

- . Total program costs
- . System quantities
- . Periods of performance
- . Annual cancellation ceilings
- . Incidence of cancellation
- . Cancellation ceiling funding approach
- . Claims payments
- . Other comments.

Including the six Maritime Administration (MARAD) MYP contracts, forty-two MYP applications have been identified. These forty-two contracts are distributed as follows (number of contracts; % of total):

- . electronics - 11 (26%)
- . trucks/vehicles - 3 (7%)
- . tanks/tracked vehicles - 5 (12%)
- . aircraft - 2 (5%)
- . ships - 15 (36%)
- . missiles/torpedoes - 4 (10%)
- . other - 2 (5%).

As noted previously, complete data have not yet been collected on each system listed in Table III-3 due to the historical nature of the contracts. This information has been requested, is in the process of being provided, and will be integrated into the Phase II portion of the study as it becomes available. However, using the data as shown in Table III-3, important summary statistics are derived and presented in the following paragraphs.

Table III-4 illustrates some aggregated data from the individual entries of the table just shown. As indicated, the durations of the MYPs vary from two to five years across all commodity groups with no single duration being more common than any other. Average commodity group MYP contract dollar values ranged from a low of \$30.2M for the two tank/tracked vehicle MYPs to a high of over \$1B for the aircraft MYPs (dominated by the RA-5C). The MYPs ranged from a low of under \$10M to a number of \$2B plus contracts for all those contracts considered. Of the entire grouping, for those with known contract values; however, one large aircraft and two large ship contracts dominate this average. There appears to be no discernible trend relative to the duration or average dollar value, other than the obvious point that the ship and aircraft contracts have the largest dollar thresholds.

There are some interesting aspects relative to the cancellation experiences of the forty-two contracts under study. In the most stringent view, six MYPs were cancelled:

	<u>Cancellation Fee</u>	<u>Cancellation Fee (% of total contract)</u>
. LHA	(\$109.7M)	6%
. RA-5C	(\$15.3M)	1%
. SQQ-23	(\$3.6M)	4%
. Snillelagh	(\$2.5M)	1%
. MK-46	(\$0.95M)	1%
. 89,000 DWT Tanker	(\$0)	UNKNOWN

TABLE III-4

MYP SUMMARY STATISTICS

MYP CHARACTERISTICS	COMMUNITY TYPE						
	COMMUNICATIONS/ ELECTRONICS	TRUCKS/ ENGINES	TRACKED VEHICLES	AIRCRAFT	SHIPS	MISSILES/ TORPEDOES	OTHER
TOTAL # MYP CONTRACTS	11	5	2	2	15	4	2
AVERAGE MYP CONTRACT DURATION (YRS)	2 Yr - 1 3 Yr - 5 4 Yr - 2 4 Yr - 1 Unknown - 2	2 Yr - 1 3 Yr - 4 4 Yr - 0 5 Yr - 0 Unknown - 0	2 Yr - 0 3 Yr - 2 4 Yr - 0 5 Yr - 0 Unknown - 0	2 Yr - 0 3 Yr - 1 4 Yr - 1 5 Yr - 0 Unknown - 0	2 Yr - 1 3 Yr - 2 4 Yr - 5 5 Yr - 0 Unknown - 8	2 Yr - 1 3 Yr - 2 4 Yr - 0 5 Yr - 0 Unknown - 1	2 Yr - 0 3 Yr - 0 4 Yr - 0 5 Yr - 0 Unknown - 2
AVERAGE DOLLAR VALUE	\$65.6M (10 contracts)	\$80.0M (3 contracts)	\$30.0M (2 contracts)	\$1.25B (2 contracts)	\$583.0M (13 contracts)	\$213.5M (4 contracts)	N/A N/A
DOLLAR VALUE RANGE	\$6.2M-\$188.7M	\$22.3M-\$164.2M	\$13.5M-\$47.0M	\$214.0M-\$2.3B	\$21.6M-\$14.1B	\$172.5M-\$481.0M	N/A
# CANCELLATIONS	1	0	0	1	2	2	N/A
CANCELLATION CEILING AS % OF CONTRACT VALUE	SLQ-32 - 26.5% ALQ-155 - 8.8% WSC-3 - 11.0% TPS-59 - 3.0% SQN-23 - 4.0% SQS-23 - 12.0% SLQ-25 - 15%	Unknown	Unknown	Unknown	DD-963 - 8.1% USCG Cutters - 5% SSN-688 - 3% SSN-688 - 5% MK-46 - 1% MK-46 Mods - 5%	Unknown	N/A N/A
CANCELLATION POINT VS. MYP CONTRACT LENGTH (year of cancellation/ length of MYP)	SQS-23 - (4/4)	N/A	N/A	RA-5C - (3/3)	LHA-1 - (4/5) MARAD-Unknown Shillelagh - (2/2)	N/A	N/A

Those shown here along with the paid cancellation fee are not clearly cancellations in reading the supporting literature. For example, the RA-5C quasi-MYP resulted in a decision to not exercise the third year's buy of aircraft. In choosing this option, the government paid Rockwell \$15.3M for advanced materials procurement that were used as spares. MARAD's decision to cancel an MYP resulted in no cost to the government. To the extent that there were cancellations, the majority occurred in the last year of the MYP except for the MK-46 which had a 2nd year cancellation. The two most important reasons for cancellation were requirements changes (LHA-1, RA-5C) and funding problems (MK-46, SQQ-23).

In the most stringent view of cancellation, six of forty-two MYPs were cancelled for a 14% cancellation rate. This conservative rate substantially exceeds that published in previous studies from the early and mid-1960s, during which time a cancellation rate closer to 1% was believed to be realistic. It should be noted that this 1% figure includes all MYPs, (primarily supplies and services) and is not applicable to MYPs for "major" systems. This may also be tainted by the fact that the study quoting a 1% cancellation rate was done in the mid 1960's, when MYP was initially implemented by the Army. Again, a maximum cancellation rate of approximately 14% has been estimated from the raw data. It is possible that, pending further clarifying data and/or interpretation of the data during Phase II, the rate could be determined to be somewhat lower. However, for study purposes, a more pessimistic cancellation rate of 14% will be used.

As indicated in the figures, only on the LHA contract was a substantial (in dollar value terms and relative to the total contract value) cancellation fee paid (\$109.7M). The remaining cancellations involved fees below 5% of the MYP contract value. It would appear that Congressional attitudes toward MYP were shaped primarily by the LHA experience in 1972.

Cancellation ceilings as a percentage of contract value have not been identified for all those MYP acquisitions shown in Table III-3. For those contracts where complete data exist, this percentage ranges from 3% to 27% for communications/electronics systems, 8% for certain ship contracts, and up to 3% for torpedo programs. The U.S. Coast Guard MYP contracts provide interesting cases in that their cancellation ceilings are figured as strict percentages of contract value which decline at specified rates as a contract proceeds to term.

For whatever reasons, the majority of those MYPs for which data exist have had unfunded or partially funded cancellation ceilings. In several instances of Army MYP, no data have yet been uncovered to determine how the cancellation ceilings were funded. Two major MYP users, NAVELEX and NAVSEA, have indicated that full funding has not always been used for MYP cancellation ceilings. The U.S. Coast Guard and MARAD likewise have not always funded cancellation ceilings citing Congressional guidance for civilian agencies not to fund contingent liabilities. Certain comptroller organizations indicated that "precedence" existed for less than fully funded cancellation ceilings. Their examples centered around Fixed Price Incentive (FPI) contracts in which funds were budgeted for the target cost versus the higher ceiling cost, implying that the "contingent liability" (ceiling minus target) remained unfunded. In summary, even though the full funding guidance has existed since the inception of MYP, successful MYPs have been accomplished with both full funding and partial funding.

In reviewing the collected data, certain characteristics of successful and unsuccessful MYPs are apparent. One "classic" case involves the AN/SLQ-32 shipboard EW system which was an MYP during the late 1970s. The SLQ-32 program imposed a strict Design-to-Cost (DTC) program during development, leading to a high degree of confidence in system cost prior to production. Based on this program and a firm system requirement, the Navy entered into an approximately \$200M MYP without funding the cancellation ceiling, which in the first year, was roughly \$50M. This acquisition went to term with no cancellation. In this instance, it is quite clear that the careful use of a DTC program was instrumental in the eventual MYP success, suggesting that other MYPs might be linked to DTC programs.

At the other end of the spectrum, the Navy's use of MYP for the DE-1052, DE-1078, LHA-1, DD-963, SSN-688, and LST ships has been somewhat unsuccessful. More specifically, the contracts have had numerous claims problems that would most likely have occurred regardless of the contract type. The continuing necessity for ship design and drawing changes, the limited numbers of ships bought at one time, and the potentially large up front funds required on a ship MYP, indicate that ship acquisitions might not be the best MYP candidates under a partial funding approach.

4. MYP SAVINGS ESTIMATES

One of the primary study objectives has been to identify the degree to which savings have accrued to the government through the use of MYP. Defense Department officials, service representatives, and industry spokesmen have alluded to savings ranging from 10% to 30% for MYP depending upon numerous circumstances, including type of system, number of units, labor/material mix among others. GAO has evaluated savings estimates within DoD, and noted that if certain discount rates and inflation avoidance parameters are used, savings can drop to the 0-8% level. In addition to the debate over the magnitude of MYP savings, the methodology by which savings are to be calculated and validated is in dispute. In performing Phase I of this study, very little reliable and verifiable data have been collected relative to actual savings. To address this important savings issue, a theoretical analysis involving potential savings from learning curves has been undertaken as described in the following pages.

Existing MYP literature identifies a number of elements which contribute to the overall savings from the use of MYP. This list includes:

- . Economic Order Quantity (EOQ) procurements
- . Labor continuity
- . Improved productivity due to improved capital acquisition/investments
- . Reduced administrative cost relative to the contractual process
- . Inflation avoidance.

The relative importance of these segments to the overall savings is not entirely quantifiable; however, the EOQ procurements, labor continuity and productivity from capital investments are recognized as the major contributors. To approximate the benefits/savings from MYP in these three categories, learning or improvement curves have been used to provide theoretical bounds within which MYP savings would be limited. This learning curve analysis has been employed because it addresses many critical aspects bearing on the issue of savings, e.g., potential savings from various commodity groups, potential savings from various learning rates for material and labor, potential savings from alternative labor and material mixes within a commodity group.

The learning curve analysis shown here realistically reflects the MYP case in that it represents a continuous production environment versus the AYP case in which there are annual breaks in production. In the AYP situation, only one year's learning or learning for a suboptimum quantity of systems is achievable. Successive annual contracts, in the worst case, begin each new year's production at unit one prices. These annual contracts, in a middle ground case, might begin each new year's production at a negotiated position somewhere between unit one and the preceeding year's termination point cost. In either event, the AYP case does not offer the same degree of learning benefits as an MYP case due to the breaks in production. Therefore, the differences in unit costs due to learning serve as an excellent proxy for estimating savings from MYP contracts.

To initiate the analytical construct, certain recurring terms are defined below along with assumptions/constraints which bound the analysis:

- (1) L = labor content of a system (fraction of system content)
- (2) M = material content of a system (fraction of system content)
- (3) L_L = learning curve for labor
- (4) L_M = Learning curve for material
- (5) L/M = ratio of labor/material for a system
- (6) $L+M = 1$
- (7) $0 \leq L \leq 1, 0 \leq M \leq 1$
- (8) $L_L < L_M$
- (9) $0.75 \leq L_L$ or $L_M \leq 1.0$

Items (1) through (5) are self-explanatory definitions for labor, material, learning, and system composition. Item (6) indicates that the material and labor components of a system represent 100% of its cost, where L and M can take on any value from 0 to 100%. Of course, no system is all labor or all material so that L and M generally vary in 30%/70% range respectively. Item (7) suggests that the composition of a system can vary in terms of its labor and material components, and that the closer to unity L/M is, the more labor intensive the system, and conversely, the closer to 0 L/M is, the more material intensive. Item (8) states that the degree of learning attributable to manufacturing labor always exceeds that attributable to material purchasing and handling, e.g., labor learning of 75% "exceeds" material learning of 80%. Item (9) serves to place realistic bounds on the

degree to which labor and material learning can be gained in any manufacturing endeavor. In this case, a lower limit of 75% has been chosen along with an upper bound of 100%, i.e., no learning.

For purposes of our analysis, a Wright learning curve of the form:

$$C_Q = C_1 Q^b$$

where;

- C_Q = cumulative average unit cost at quantity Q
- C_1 = first unit cost
- Q = quantity of units, Q
- b = slope of learning curve

where;

$$b = \frac{\ln \text{ of learning curve, e.g., } \ln 0.9 \text{ for } 90\%}{\ln 2}$$

has been used. The remainder of this section utilizes these terms and equations to evaluate MYP savings potentials.

A number of hypotheses and questions are of interest in assessing the savings potential from MYP applications. What happens to overall savings as the mix of labor and material in a system varies over specified ranges? What quantities of a commodity are required to induce a given level of savings for various rates of learning and various labor/material mixes? How realistic are estimated savings from MYP relative to those postulated using the theoretical learning curve analysis? These and other aspects of the savings issue are discussed in the following paragraphs.

Certain general statements become clear in reviewing the learning curve assessment. Those commodity groups that are more labor intensive, vis-a-vis material intensive, will have more potential savings due to the generally greater learning for manufacturing labor than for material. Those commodity groups in which smaller numbers of systems are acquired are less subject to learning than greater quantities of systems. If $L_L = L_M$, the reduction in cumulative average unit costs follows the learning rate regardless of the relative mix of labor and material in a system. At the extremes, where $L/M = 0$ or $L/M = 1$, the overall learning approaches either L_M or L_L , respectively. It is recognized that as L approaches 1 and M approaches 0, L/M approaches $+\infty$, an unrealistic case in terms of system composition.

Given these considerations, Figure III-4 was constructed to show the relationship between system quantity and cumulative average unit cost. Two cases are depicted to bound the problem realistically. Case I, a relatively conservative situation, considers a system in which $L_L = 0.9$, $L_M = 0.95$ and L/M varies from 0 to 1 in increments of 0.25. Case II, an extremely optimistic situation, represents a situation in which $L_L = 0.75$, $L_M = 0.8$ and L/M varies from 0 to 1 in increments of 0.25. The quantities considered range from 1 to 1,000 units. These extremes cover all the combinations of L_L and L_M between 0.75 - 0.90 and 0.8 - 0.95, respectively.

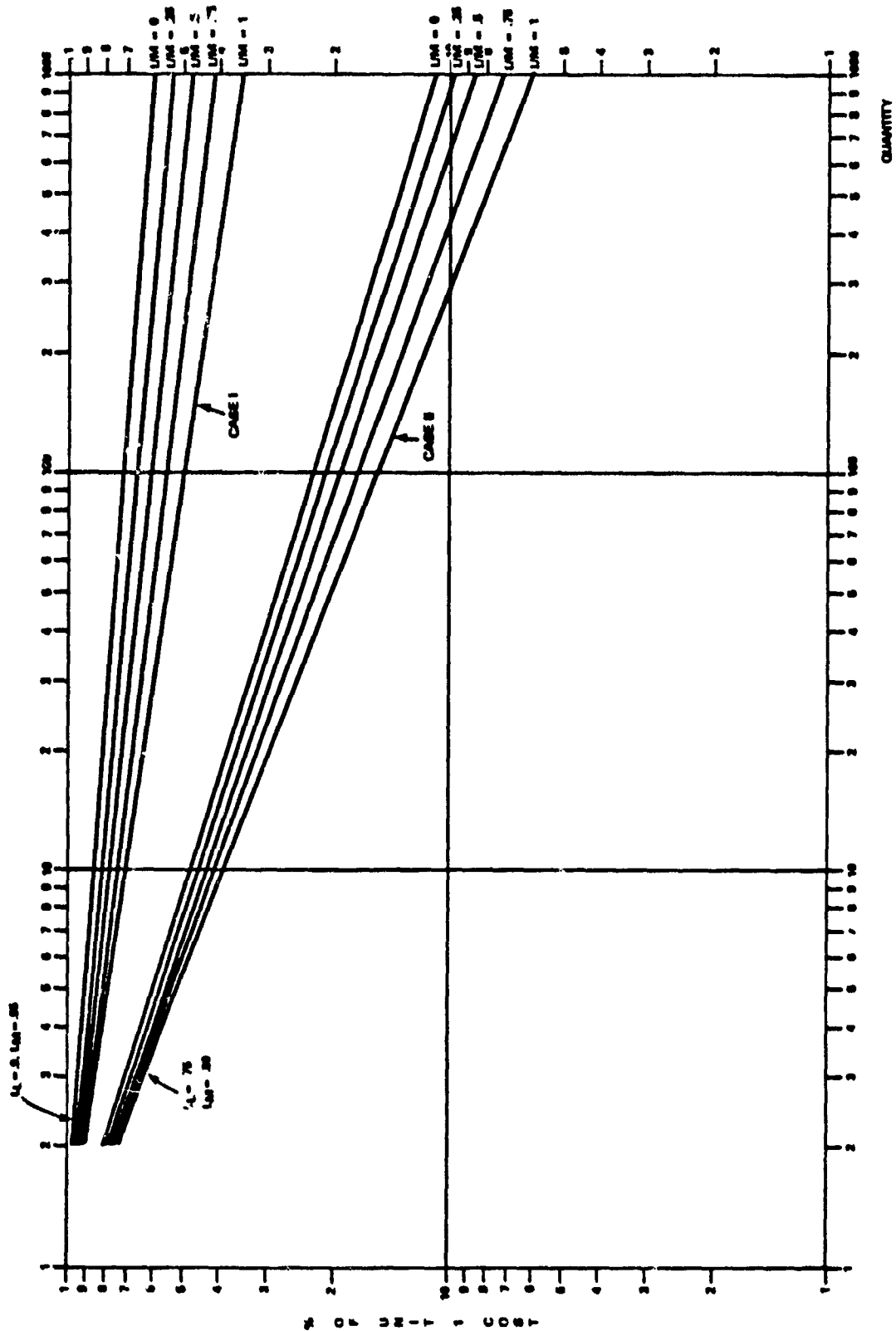


FIGURE III-4 LEARNING CURVE ESTIMATED SAVINGS

As shown in Figure III-4, Case I data indicate that 100 units cumulative average unit costs range from 50% to 72% of first unit costs as L/M (the labor/material mix) ranges from 1 to 0. Case II data demonstrate more dramatic potential savings at 100 units, where cumulative average unit costs range from 16% to 23% as L/M ranges from 1 to 0. To demonstrate the effects of quantity on unit cost, cost reductions of over 30% are evident in both of the depicted cases for as few as 130 units under the assumptions noted. In summary, it is not unrealistic to expect 10% to 15% savings for MYP contracts involving as few as fifteen systems.

1) Shillelagh Missile Savings Example

As an indication of the difficulty of verifying savings associated with historical MYPs, an example from the Army's Shillelagh missile acquisition is discussed. Table III-5 shows raw data received from the U.S. Army Missile Command (MICOM) for the Shillelagh procurement.

TABLE III-5 SHILLELAGH MISSILE DATA

<u>CONTRACT NUMBER</u>	<u>CONTRACT TYPE</u>	<u>FISCAL YEAR</u>	<u>QUANTITY</u>	<u>AVERAGE UNIT COST (\$)</u>	<u>TOTAL COST (\$M)</u>
555	CPIF	1965	1,395	15,125	21.1
13705	CPIF	1966	16,599	4,445	73.6
002	PFIF (sic)	1967	21,846	2,902	63.4
0059 (O)	FFP	1969- 1971	52,700	-	100.8
0059 (F)	FFP	1969- 1971	35,903	1,925	69.1

Learning curve for contracts 13705 and 002 implies first unit cost of \$83,697 and slope of 79.6%. Projection for a quantity of 35,903 versus actual cost:

	<u>Projection</u>	<u>Actual</u>	<u>% Savings</u>
Average Unit Cost	\$2,291	\$1,925	16%
Total	\$82.2M	\$69.1M	16%

- (O) Original contract cancelled in March 1971
(F) Final contract

MICOM, using these raw data from the 1966 and 1967 contracts cited above (#s 13705 and 002), estimated a learning curve with a 79.6% slope. They further indicated that a projected average unit cost of \$2,291 would result for a 35,903 unit MYP contract, leading to an \$82.2M total cost. The actual MYP contract (0059) resulted in average unit costs of \$1,925, leading to a total cost of \$69.1M. Comparing either the actual average unit cost or the total cost to the MICOM projection, a 16% savings is calculated.

The difficulty in judging how realistic the 16% savings number is stems from two areas. First, if one assumes that the stated first unit cost of \$83,697 is correct and that a 79.6% learning curve is accurate, it should be possible to duplicate the MICOM provided number for the projected average unit cost of \$2,291. Using the learning curve formula previously shown, a unit cost of \$2,651 is the result based on:

$$\begin{aligned} C_{35,903} &= (\text{Unit 1 cost}) (35,903)^{-0.3291596} \\ C_{35,903} &= (\$83,697) (35,903)^{-0.3291596} \\ C_{35,903} &= (\$83,697) (0.031669) \\ C_{35,903} &= \$2,651. \end{aligned}$$

This number reflects 8.6% savings from the previous estimates of \$2,902/unit from the 002 contract.

Second, if one assumes that the \$1,925/unit cost is correct and that a 79.6% learning curve is accurate, it should be possible to duplicate the MICOM - provided number for the stated first unit cost of \$83,697. Using the learning curve formula previously shown, a cost of \$60,785 is the result based on:

$$\begin{aligned} C_{35,903} &= (\text{Unit 1 cost}) (35,903)^{-0.3291596} \\ \$1,925 &= (\text{Unit 1 cost}) (35,903)^{-0.3291596} \\ \$1,925 &= (\text{Unit 1 cost}) (0.031669) \\ \text{Unit 1 cost} &= \$60,785. \end{aligned}$$

As illustrated, the estimated 16% savings is difficult to evaluate even using the raw contractual data provided by the command originating and implementing the MYP acquisition. Discussions are underway with MICOM to determine what type of learning curve was used in calculating the estimated savings, and to resolve the noted discrepancies.

2) AN/ALQ-155 Savings Example

Northrop provided savings estimates from the AN/ALQ-155 MYP experience. It was indicated that the first 2-year MYP was priced at \$54M versus the \$57M estimated cost for two one-year acquisitions. Moreover, the next 3-year MYP was priced at \$54M versus the \$67M estimated for three one-year acquisitions. The two MYP contracts at \$108M (\$54M plus \$54M) reflect a 12.9% savings over the \$124M (\$57M plus

\$67M) estimate for five one-year contracts. This estimated savings stems from the comparison of Northrop's five one-year proposals to the two actual MYP contracts. Beyond this type of crude comparison, there is no completely satisfactory method to reasonably assess historical savings.

3) Alternative Savings Approaches

It is possible to calculate the theoretical savings generated by MYP vis-a-vis AYP by employing the following construct. Assume initially the extreme AYP case in that the learning curve goes back to "square 1". That is, at the end of each year, workers forget all the learning that was acquired over the year, management forgets all the production enhancing techniques introduced etc. The cost per item (C) to produce Q items under an MYP contract covering K years would be:

$$C_{QM} = C_1 Q^b$$

But, the cost per item to produce the same Q items under K equal annual contracts would be:

$$C_{QA} = C_1 \left(\frac{Q}{K} \right)^b = C_1 \frac{Q^b}{K^b}$$

Therefore, the percent savings due to MYP can be shown by:

$$\frac{C_{QM}}{C_{QA}} = \frac{C_1 Q^b}{C_1 \frac{Q^b}{K^b}} = K^b$$

Note that the percent savings do not depend on the total quantity procured, but only on the number of years in the AYP, (K), and the learning curve coefficient, (b). Table III-6 summarizes the percent potential savings from MYP vice AYPs with terms from 1-5 years. These savings reflect the extreme optimistic case (i.e. MYP savings are greatest) where there is no learning from year to year in the comparable AYPs.

Table III-6
Savings Due to MYP Vis-A-Vis AYP - No Learning Case

<u>Slope of Learning Curve</u>	<u>Coefficient "b"</u>	<u>Percent Potential Savings From MYP</u>				
		<u>K=1</u>	<u>K=2</u>	<u>K=3</u>	<u>K=4</u>	<u>K=5</u>
.99	-.0145	0	1	1.6	2.0	2.3
.95	-.0740	0	5	7.8	9.7	11.2
.90	-.1520	0	10	15.4	19.0	21.7
.85	-.2345	0	15	22.7	27.7	31.4
.80	-.3219	0	20	29.8	36.0	40.4

In most cases, of course, it is unrealistic to assume that in AYP the contractor forgets "everything he knows" about how to produce the item in question between contracts. Suppose he "remembers" a portion R of what he has learned, where R is a parameter $0 \leq R \leq 1$. $R = 0$ is the extreme case tabulated above in Table III-6. $R = 1$ corresponds to complete recall, and thus no savings from MYP whatsoever. For intermediate values of R we derive a somewhat complex formula as follows:

$$C_{QA} = C_1 \left(Q \left(\frac{1}{K} + \frac{R}{K} + \frac{R^2}{K} + \dots + \frac{R^{K-1}}{K} \right) \right)^b$$

Therefore:

$$\frac{C_{QM}}{C_{QA}} = \frac{1}{\left(\frac{1}{K} + \frac{R}{K} + \dots + \frac{R^{K-1}}{K} \right)^b}$$

Table III-7 summarizes the percent potential savings from MYP in the more realistic case where the contractor "remembers" one-half of what he has learned in the previous year.

Table III-7
Savings Due to MYP Vis-A-Vis AYP - 50% Learning Retention Case

Slope of Learning Curve	Coefficient "b"	Percent Potential Savings From MYP (Assuming R = .5)				
		K=1	K=2	K=3	K=4	K=5
.99	-.0145	0	.4	.8	1.1	1.4
.95	-.0740	0	2.1	3.9	5.5	6.8
.90	-.1520	0	4.3	7.9	10.8	13.4
.85	-.2345	0	6.5	11.9	16.3	19.9
.80	-.3219	0	8.8	15.9	21.6	26.3

These results suggest that it is not unrealistic to expect to 10-15% savings from MYP. However, it should be noted that the results are very sensitive to the three parameters: the slope of the learning curve; the number of AYP contracts; and the assumed level of learning retention. For example, compare potential savings calculated for the K=3 and b = -.1520 cases presented in Tables III-6 and III-7. The calculated potential savings, where the contractor retains nothing of his previous learning, reported in Table III-6, suggest MYP will generate 15.4% more savings than AYP. If we assume the contractor retains only one-half of his previous learning as reported in Table III-7, the calculated savings is reduced to 7.9% or a reduction of approximately one-half (15.4% vs 7.9%).

The preceeding discussion offers a unique view of savings generated by MYP versus AYP practices. In particular, it focuses on savings as a function, not only of quantity, but of the number of years or annual contracts. The results suggest that MYP practices will indeed generate savings over AYP contracts. The theoretical learning curve cases of Figure III-4, using system quantity as the savings driver, and the hypothetical examples of Tables III-6 and III-7, using number of contracts as the savings determinant, are consistent with the view that MYP offers real savings.

4) Savings Summary

In summary, there are clear savings to be derived from the application of MYP to major systems. The magnitude of these savings is very difficult to identify precisely, and will depend upon a number of factors, including:

- . the degree to which inflation avoidance is allowable as a cost savings
- . the number of systems to be procured
- . the discount rate applied to the present value analysis
- . the labor/material mix of the system.

The range of stated historical savings for MYPs, while intuitively appealing, is not fully verifiable. To imply that all MYPs will lead to 10%-30% savings is misleading and likely an overstatement based on historical experience. GAO's savings estimates of 3%-8% are probably more realistic, but believed to be on the low side on the basis of preliminary analysis of Phase I data. The theoretical learning curve discussions presented earlier indicate that savings of 10%-15% are realistic for quantities as few as 15 units, even with labor and material learning rates of 90% and 95% respectively. Other hypothetical examples (Tables III-6 and III-7) show similar savings opportunities for MYP over AYP based strictly on the number of AYPs.

The process of documenting and validating historical MYP savings has been marginally successful to date. While it is fairly clear that MYP savings have accrued to date, the magnitude of these savings is not clear. Each MYP contract has unique aspects that will determine the degree of savings. A number of interview respondents stated that their measure of MYP savings for new starts (FY82 and FY83 programs) lies in the difference between what had been budgeted years ago and recent MYP proposals. Unfortunately, there is no way to use this type of "savings" estimate because of the method of developing a budget estimate. It is clear that acquisitions with large system quantity requirements are candidates for the largest degree of savings. Small buys of ships, for example, may not offer the kinds of savings from MYP that are incentive enough to give up the flexibility of AYP contracts.

As an interesting adjunct to the savings discussion, Table III-8 shows a list of past MYPs and savings associated with those acquisitions. This table appeared in DoD Congressional testimony in 1981 in support of MYP. Efforts are continuing to assess and validate the claimed savings by discussing these acquisitions with the program offices in which these MYPs originated.

5. APPROACHES TO MYP FUNDING

The single most important controversy in MYP centers on the degree to which cancellation ceilings should be funded. Congress, GAO, OMB, some segments of OSD and Service Comptrollers indicate that full funding for MYP is the preferred approach just as it is for AYPs. Service acquisition managers, contracting officers and other segments of OSD indicate that partial funding is the most realistic means of implementing MYP on a wider scale. Formal Congressional, OMB and DoD guidance (OMB Circular A-11, DoD Directive 7200.4) states that full funding will be used in purchasing weapon systems so that at this time, as in times past, MYPs are to be fully funded.

The rationale behind full funding is that each year's requirements and costs are known to and approved by all parties, including Congress, who authorizes the funds, the Services who obligate the funds, and contractors, who expend the funds. Under full funding, each year's end items are paid for, such that should the requirement be waived in a subsequent year, no further liabilities will be incurred. This is the government's traditional means of doing business in weapons acquisition.

Advocates of MYP believe that full funding of cancellation ceilings or other contingent liabilities will limit the implementation of MYP by creating a "bow wave" or large up front funding bulge which squeezes out other competing systems. This "bow wave" would occur due to the structural differences in the funding pattern of a fully funded MYP contract relative to a string of AYPs. This also would exist regardless of the fact that the overall MYP contract most likely would be cheaper than a string of AYPs. To alleviate this up front funding problem, certain MYP advocates suggest numerous partial funding approaches as reasonable alternatives. The rationale behind partial funding stems from two sources: the degree of savings inherent in MYP over AYP and the historically low probability of cancellation. Partial funding of the cancellation ceiling lowers the obligational authority associated with MYPs and would thus reduce the crowding out effect noted previously.

Critics of partial funding state that, in addition to the fact that it violates full funding guidance, future Congresses may be locked in by improper uses of partial funding. Additionally, critics note that the true costs of weapon systems might be more easily masked under partial funding approaches, or that this might lead to the delivery of partial systems. These and other objections have traditionally been voiced against the possible use of partial funding.

TABLE III-8
EXAMPLES OF DOD STATED SAVINGS IN MULTIYEAR CONTRACTS
[Dollars in Millions]

Item	Single year	Multiyear	Savings	Percent
BQQ-5 transmission (sic).....	\$ 22.6	\$ 20.4	\$ 2.2	11
SLQ-25 transmitting set.....	12.0	8.2	3.8	32
RA-5C aircraft.....	167.6	153.4	14.2	9
SSQ-23 sonar receiver.....	81.0	60.2	20.8	26
TOW Missile.....	114.6	102.0	12.6	11
Shillelagh missile.....	113.3	100.8	12.5	11
Propellant oxygen liquid.....	10.9	6.9	4.0	37
BLU 63/B metal parts kits.....	10.0	8.3	1.7	17
DE 1052 ship.....	321.4	292.6	28.8	9
DE 1078 hip.....	233.2	217.7	15.5	7

In the collection of contract data on past MYP applications, it is interesting to note that full funding has not been used in all cases. Realizing that only incomplete data are available currently, fully one-third of the MYPs have not fully funded the cancellation ceiling. This finding is an indication of the ability of the government and its contractors to take risks and enter into MYPs without total coverage of government and contractor directed expenditures. Specific contractual language is being pursued to determine how the cancellation clauses were structured. This lack of funding has existed in instances where the cancellation ceiling was far in excess of the \$5M limitation. This lack of funding appeared to be no impediment to the successful completion of these MYPs.

As noted in an earlier section, the U.S. Coast Guard, a successful user of MYPs, does not fund cancellations citing Congressional direction for civilian agencies not to fund contingent liabilities. Additionally, Service comptroller representatives indicate that "precedence" exists for a policy leading to partial funding. The example cited is that of FPI contracts in which funds are budgeted for price targets not for the higher price ceilings, even though the potential exists for exceeding target. This difference between target and ceiling represents a contingent liability that might not be fully funded. In reality, this situation is entirely comparable to less than fully funding a cancellation ceiling.

In summary, in spite of existing full funding guidance, MYPs have been used successfully with partial funding for electronics/communications, ships and helicopters. Moreover, "precedence" exists for a partial funding policy.

The following discussion compares full funding and a number of partial funding alternatives in a hypothetical MYP acquisition to demonstrate more clearly the advantages and disadvantages of funding options. This set of examples draws heavily upon and extends the concepts of a recent Army publication focusing on the impacts of MYP.⁶ Additionally, hardware contractor perspectives on MYP funding have been used in conjunction with certain of the statistical data uncovered in the course of this research to enhance further the funding concepts. The funding alternatives to be addressed include:

- . full funding
- . contractor financing
- . incremental funding
- . termination liability funding
- . "cash flow" funding
- . "risk pool" funding
- . "cancellation risk" funding.

As described, all the alternatives except full funding are variations of partial funding and would require deviation from existing funding guidance.

A hypothetical \$300M, three-year MYP with a 33 unit per year delivery rate will serve as the basis of the example. Nonrecurring costs of \$35M are assumed to be amortized evenly across all three years. Primary recurring costs in the amount of \$165M are also assumed to be amortized evenly over the three year term. EOQ purchases of materials, components, parts, etc.,

are made in the amount of \$100M. Within the \$100M EOQ purchase, \$60M and \$40M are to be obligated in years 1 and 2, respectively; however, contractor expenditures will be assumed to be required at \$50M in year 1, \$30M in year 2, and \$20M in year 3.

1) Full Funding

In carrying out the full funding alternative, the government attempts to match the contractor's obligation profile rather than his expenditure profile. Table III-9 demonstrates the annual funding, expenditure and hardware delivery profiles for a full funding approach.

Table III-9 Full Funding Profile

	<u>FY 1</u>	<u>FY 2</u>	<u>FY 3</u>
Contractor Expenditures			
EOQ	\$50M	\$30M	\$20M
RC	\$55M	\$55M	\$55M
NRC	<u>\$11.67</u>	<u>\$11.67</u>	<u>\$11.66M</u>
Subtotal	\$116.67M	\$96.67M	\$86.66M
Government Funding			
EOQ	\$60M	\$ 40M	0
RC	\$55M	\$ 55M	\$55M
NRC	<u>\$11.67M</u>	<u>\$ 11.67M</u>	<u>\$11.66M</u>
Subtotal	\$126.67M	\$106.67M	\$66.66M
Overfunding/ (Underfunding)	\$10M	\$10M	(\$20M)
Annual Deliveries	33	33	33

As indicated in the table, because the government funded the \$100M EOQ in the first two years vice the three year contractor expenditure, a balance of \$20M has been created somewhat unnecessarily. This balance would be accentuated further should the NRC amortization assumption be relaxed, i.e., if all \$35M were funded in the first year. In this example, no issues arise over cancellation risks as no cancellations ceilings are created.

2) Contractor Financing

In the case of a level-funded MYP, under the same assumptions, a number of important issues become evident. Table III-10 depicts a case in which the contractor finances the initial year, after which time the government funding finances the remaining years. As shown, a \$16.67M cancellation liability exists should the contract be cancelled after year one. This liability is reduced to \$13.34M after the second year, but is not eliminated until the MYP goes to term. It is not clear that a contractor would be willing to enter this type of MYP financing arrangement, especially under conditions of high interest rates and 80% progress payments. As in the previous example, should the NRC amortization assumption be relaxed, the cancellation ceiling could rise to approximately \$40M in the first year, and approximately \$36M in the second year.

Table III-10 Contractor Financing Profile

	<u>FY 1</u>	<u>FY 2</u>	<u>FY 3</u>
Contractor Expenditures			
EOQ	\$50M	\$30M	\$20M
RC	\$55M	\$55M	\$55M
NRC	<u>\$11.67</u>	<u>\$11.67</u>	<u>\$11.66M</u>
Subtotal	\$116.67M	\$96.67M	\$86.66M
Government Funding			
EOQ			
RC	\$100M	\$100M	\$100M
NRC	_____	_____	_____
Subtotal	\$100M	\$100M	\$100M
Overfunding/ (Underfunding)	(\$16.67M)	\$3.33M	\$13.34M
Annual Deliveries	33	33	33

3) Incremental Funding

Although incremental funding is used primarily for research and development efforts, it is one of the partial funding alternatives to be considered for MYP. As in the contractor financing case, a \$100M level-funded MYP is postulated for this incremental funding example. Table III-11 depicts an incremental funding approach using the same groundrules as in the previous alternatives. In this instance, no cancellation ceiling is created, but in the event of cancellation, fewer end items would be delivered. To make complete deliveries in years two or three, in the event of cancellation, there would also be added appropriations needed.

Table III-11 Incremental Funding Profile

	<u>FY 1</u>	<u>FY 2</u>	<u>FY 3</u>
Contractor Expenditures			
EOQ	\$50M	\$30M	\$20M
RC*	\$38.33M	\$58.33M	\$68.34M
NRC	<u>\$11.67</u>	<u>\$11.67</u>	<u>\$11.66M</u>
Subtotal	\$100M	\$100M	\$100M
Government Funding			
EOQ			
RC	\$100M	\$100M	\$100M
NRC	<u> </u>	<u> </u>	<u> </u>
Subtotal	\$100M	\$100M	\$100M
Overfunding/ (Underfunding)	\$10M	\$10M	(\$20M)
Annual Deliveries	23	35	41

* Calculated by subtracting EOQ and NRC expenditures from the \$100M government funding available each year.

4) Termination Liability Funding

One of the frequently advocated compromise positions between full funding and contractor financing is termination liability funding. This approach is an attempt to match more evenly contractor expenditures and government funding levels without the initial funding bulge associated with full funding. In this example, \$5M in termination liability funding is provided in each of the first two fiscal years to cover future years' work-in-process costs. Table III-12 illustrates a possible termination liability funding approach within the framework of the hypothetical example used previously. This deliberately simplistic example does not address some of the contractual complexities associated with termination liability funding. As noted in the example, the \$5M termination liability funding provided in each of the first two years has the potential effect of lessening the cancellation liability in the event of contract cancellation. Moreover, this alternative requires less initial funding than would be necessary under full funding.

Table III-12 Termination Liability Funding Profile

	<u>FY 1</u>	<u>FY 2</u>	<u>FY 3</u>
Contractor Expenditures			
EOQ	\$50M	\$25M	\$15M
RC	\$55M	\$55M	\$55M
NRC	\$11.67M	\$11.67M	\$11.66M
Termination Liability	<u>-</u>	<u>\$ 5M</u>	<u>\$ 5M</u>
Subtotal	\$116.67M	\$96.67M	\$86.66M
Government Funding			
EOQ	\$50M	\$25M	\$15M
RC	\$55M	\$55M	\$55M
NRC	\$11.67M	\$11.67M	\$11.66M
Termination Liability	<u>\$ 5M</u>	<u>\$ 5M</u>	<u>\$ -</u>
Subtotal	\$121.67M	\$96.67M	\$81.66M
Overfunding/ (Underfunding)	\$ 5M	0	(\$ 5M)
Annual Deliveries	33	33	33

5) "Cash Flow" Funding

As another alternative, certain contractors have suggested "cash flow" funding as a reasonable means of expanding the use of MYP. "Cash flow" funding, as used here, is an attempt to match the government's funding level against a contractor's expenditure profile. As already shown in the full funding and to a lesser degree in the termination liability funding examples, there are mismatches in the government funding and contractor expenditure rates. It has been suggested by certain contractors that if the government wishes to implement MYP more widely without the "bow wave" or crowding out effects of full funding and termination liability funding, "cash flow" funding is a viable alternative.

Contractor data from a number of aircraft programs indicate that cash flow requirements for advanced acquisition of parts, material, components, etc., range between 20%-30% of advanced acquisition termination liability requirements in the first two years of an acquisition. This implies that termination liability funding (not just full funding) might be in excess of contractor "cash flow" requirements by a factor of 3-4 times in the early years of an MYP contract. It appears that under the "cash flow" concept, the contractor and the government could negotiate MYPs such that risks are reduced for both parties and no unnecessary obligation authority need be tied up.

6) "Risk Pool" Funding

As another alternative to full funding, the concept of establishing a DoD or Service-specific "risk pool" for MYP funding has been considered. Under this alternative, the government would move away from full funding and toward partial funding of MYPs such that cancellation ceilings are left unfunded on a contract-by-contract basis. The cancellation ceilings would be funded only partially and on an indirect basis through a "risk pool." This pool of funds would be akin to an insurance/actuarial approach where a level of obligation authority would be created in an amount sufficient to cover the cancellation ceilings of the single one or two largest MYPs, but less than that required for the sum of all current MYPs. In this case, the government would establish the "risk pool" on a judgemental basis either at the DoD, Service, or buying activity level. The pool might be allocated as a strict percentage of contract value, cancellation ceiling, or approximate termination value. The extreme case of this concept would be a situation in which the government elects to obligate no funds to a pool, but instead became a self-insurer for all contingent liabilities in MYP.

7) "Cancellation Risk" Funding

"Cancellation risk" funding is another variation of partial funding in which the degree to which cancellation fees are funded is a direct function of the historical probability of cancellation. For example, assume a \$300M, 3-year MYP with a \$45M cancellation ceiling (\$45M for years 2 and 3; \$20M for year 3), and assume further that a historical

cancellation rate of 15% has been identified. The government might, on the basis of a 15% cancellation rate, chose to partially fund the cancellation ceiling in accordance with the expected value of cancellation costs. In this example, the government may fund \$6.75M (\$45M x 15%) of the ceiling for a contingency fund as opposed to a full funding amount of \$45M. This approach, on an aggregate basis at the buying activity, Service, or DoD level, becomes the "risk pool" alternative, and is the most realistic basis for establishing an actuarial coverage account. However, this funding alternative is at variance with the full funding concepts of DoD Directive 7200.4.

As shown, there are many alternative funding approaches available for MYP. In addition to full funding, six alternative partial funding options have been examined. The contractor financing and incremental funding approaches have obvious shortcomings. "Risk pool," "cancellation risk," "cash flow," and termination liability funding each offer advantages. At this point in the research, there is no clear means of determining the suitability of these partial funding alternatives across all MYPs.

To place this funding discussion in a more formal light, the following section address two key research issues. How can the magnitude of the cancellation ceiling be adjusted? Is there a point in time after contract initiation when the savings accrued through MYP exceed the loss due to cancellation?

6. CANCELLATION CEILING ADJUSTMENT

Cancellation ceilings arise from two sources - nonrecurring and recurring expenses associated with production, and only to the degree they are unfunded do they present risks to the government and its contractors. Under the strict DAR 1-322 provisions for level-priced MYPs, cancellation ceilings will exist in a decreasing form over the term of a contract. This section of the report identifies the components impacting the magnitude of the cancellation ceiling, presents a simplistic model for calculating the ceiling, and calls out areas in which the government has control over the level of this ceiling.

The cancellation ceiling at any point during a contract can be calculated as:

$$CC_N = NRC + RC \text{ (e.g., EUQ)}$$

$$CC_N = (NRC \times (1 - N/T)) + ((\$TC - \$T_N) \times \% MTL \times \% QT-N)$$

where,

CC_N	=	Cancellation Ceiling
NRC	=	Nonrecurring Cost
RC	=	Recurring Cost
EOQ	=	Economic Order Quantity
N	=	End Of Year N (N=1 to N=T)
T	=	Max # Of Years In MYP
$\$TC$	=	Total MYP Contract \$ Value
$\$T_N$	=	Total MYP Contract \$ Expenses Through Year N
$\%MTL$	=	% Of System Cost Attributable To Material
$\%QT-N$	=	% Of Systems Remaining On MYP After N Years Of Contract To Which EOQ Will Be Applied.

This equation states that the ceiling decreases over time at two different rates. First, the nonrecurring cost contribution decreases as a linear function of the number of years of the MYP, e.g., 33%/year on a three year MYP and 20%/year on a five year MYP. Second, the recurring cost contribution has no predetermined rate of decrease.

1) Nonrecurring Cost Component

In adjusting the magnitude of the cancellation ceiling, the government and the contractor have control of both the NRC and RC components so that at the inception of an MYP contract these can be modulated with limits. Those factors impacting the value of both the NRC and RC components will be discussed in the following pages.

NRCs reflect the up front, production-related items necessary to support a given production contract, i.e., tooling, capital goods. NRC dollar values are affected by numerous factors, including;

- . Commodity Type (Ships & Aircraft vs. Electronics, Missiles, Etc.)
- . Impact of NRC on RC (Firm and Commodity Specific)
- . Probability of Cancellation (Risk to Firm)
- . Industry Economic Conditions & Outlook
- . Length of Proposed MYP Contract
- . Labor/Material Mix of Particular Commodity
- . Funding Policy (Level Pricing, FFP, FPI, Others).

The overall dollar value of NRC to be amortized over the life of an MYP will vary primarily as a function of the commodity type, such that it will be larger for ships and aircraft vis-a-vis electronics or missiles. A given level of NRC will support a given level of production that is specific to a firm and its industry position. The proposed contract length and number of required systems affect a contractor's decision to invest in NRC. The immediate and near-term economic health of an industry will affect the degree to which a firm will invest in NRC and whether it will be paid for by the government or capitalized as a normal business investment. For a given cancellation probability, the longer the MYP contract, the longer the time for NRC amortization, and hence the greater the risk to a contractor should the cancellation fees be unfunded. As described, the government has only partial control over the magnitude of the NRC; however, by its choice of funding policies it has complete control over how much NRC contributes to the cancellation ceiling. That is, to the extent the government recognizes the need to invest in NRC in an MYP contract's first year, but chooses not to fund the full amount, it will impact the ceiling magnitude.

2) Recurring Cost Component

The remaining contributor to the cancellation ceiling is composed of recurring costs, primarily in the form of economic order quantity (EOQ) purchase of materials, parts, components, assemblies, etc. Throughout the 1962-1982 time period, the Defense Acquisition Regulations have not recognized recurring costs as an allowable portion of the cancellation ceiling. These EOQ purchases are recognized as the primary reason for MYP savings due to the cost advantages inherent in larger quantity buys.⁷ In an MYP contract, it would be possible to

purchase all the required material for each year's requirements in the first year (most optimistic case). Conversely, in the AYP case, only one year's requirements are bought at a time (most pessimistic case). The government has the responsibility to negotiate with the contractor the degree to which the contractor should make EOQ purchases anywhere in between these two extremes. The more closely the government comes to the optimistic case, the greater the impact on the cancellation ceiling that is to be amortized over the term of the MYP. The more closely the government comes to the pessimistic case, the less the impact on the cancellation ceiling and the less benefits due to EOQ. In this sense, where materials might cost 50% of the total system, EOQ has a tremendous impact on the magnitude of the ceiling; however, the government has a major decision in this area that is not available in the NRC segment.

There are other important factors affecting the magnitude of the RC portion of the cancellation ceiling, including:

- . Government decision as to degree of advanced EOQ
- . Labor/material mix of particular commodity
- . Commodity type (raw material vs. finished components, shelf life)
- . Probability of cancellation (risk to contractor)
- . Funding policy (termination liability, fully funded, others)
- . Ability to pass through MYP to suppliers
- . Willingness of subcontractors to accept MYP
- . Waiver of DAR 1-322 relative to recurring costs
- . Matching of expenditure profile to funding profile.

Certainly, to the extent that the cancellation ceiling is unfunded, and large EOQ purchases are made, a contractor is at substantial risk and would be unlikely to maintain such a position. In a related vein, a contractor would be unwilling and/or unable to finance large unfunded EOQ purchases in times of high interest rates without advanced progress payments or permission to pass through interest expenses as allowable costs. A strict adherence to DAR 1-322 which requires MYP level pricing and does not permit recurring costs to be included in a cancellation ceiling virtually negates EOQ as a major contributor to MYP savings.

In summary, the magnitude of the cancellation ceiling can be adjusted slightly on the basis of the NRC component and significantly on the basis of the RC component. Shorter term MYPs will create less risk to the contractor as costs are amortized more quickly and contracts are less likely to be cancelled. The government's greatest leverage in adjusting the ceiling hinges on the EOQ decision, but the magnitude of MYP savings likewise hinges on this EOQ position.

3) "Cross-over" Point Assessment

One key objective of the task has been to derive a methodology for determining a "cross-over" point, where the break even reflects the point in time after contract inception when the potential loss from cancellation is less than the savings derived from initiation of an MYP versus an AYP. At this point in the Phase I research, two things preclude the development of a rigorous mathematical model which identifies this "cross-over" point for any given commodity type. First,

it has not been possible to unequivocally validate the savings accrued to the government from past MYPs, nor the precise rate at which the savings accrue. Second, the cancellation ceiling data for each contract on an annual basis are not complete due to the extreme historical nature of many of the acquisitions. In any event, the data do indicate certain facts which, when taken together, lay the framework for a simplistic model.

As indicated in the report, the rate at which savings accrue to the government during an MYP is recognized to be function of many things, including:

- . the NRC amortization rate
- . the degree and timing of EOQ purchases
- . the degree of continuity in the contract.

The magnitude of MYP savings has been estimated at 10%-15% over AYP. In a hypothetical MYP of any duration with "optimum" EOQ purchases in the first year, the savings rate can be estimated to be greatest in the early years and less as the contract proceeds. This is based on the fact that learning curve benefits/effects are greatest in the early years and decrease at a decreasing rate in accordance with the form of the applicable learning function. Therefore, with an assumed 15% MYP savings on a three-year MYP, the rate of savings accrual would more realistically be 8-9% in year 1, 4-5% in year 2, 1-3% in year 3, rather than 5% in each of the three years. Under these premises, the government derives more benefits in the early MYP years, and would gain "relatively more" from an early cancellation. However, this does not take into account the cancellation liability issues which mitigate this approach somewhat.

Data collected during this research have indicated that cancellation ceilings have ranged from approximately 8%-25% of contract value in the first year to 2%-5% in the next to last year. The decay rates of the cancellation ceilings are highly variable and are different for different MYP durations and commodity types. However, a hypothetical three-year MYP with cancellation ceilings of 15% in year 1 and 8% in year 2 can be used to demonstrate the concept of "cross-over" point. This cancellation ceiling example, when combined with the previous savings rate discussion, shows the degree to which "cross-over" points can be determined.

The simplistic three-year, \$100M MYP example just noted was based on a 15% savings accruing to the government at the rate of 8% in year 1, 5% in year 2, and 2% in year 3. It was also based on a cancellation ceiling of 15% in year 1 and 8% in year 2. It is recognized that these savings rates and cancellation ceilings will vary considerably, and are only generalized here for illustration purposes. The "cross-over" point in this example can be shown as in the following table:

<u>Year</u>	<u>Annual Savings</u>	<u>Cumulative Savings</u>	<u>Cancellation Ceiling</u>	<u>Cancellation Benefit/(Penalty)</u>
1	\$8M	\$ 8M	\$15M	(\$7M)
2	\$5M	\$13M	\$ 8M	\$5M
3	\$2M	\$15M	-	-
Total	\$15M	\$15M	N/A	N/A

In this instance, a "cross-over" point is established at some point during the second year of the MYP. In more strict economic terms the cross-over point can be viewed as the point where the marginal revenues (savings) due to MYP are equal to the marginal cost (cancellation ceiling) due to MYP.

While one of the primary thrusts of the Phase II research will be to use all collected data to derive more rigorous "cross-over" points, the straightforward example just presented serves to highlight trends regarding the relationship between savings and cancellations. It appears that MYPs will reach favorable "cross-over" points prior to the mid-point of the contract term. In general terms, this is because average savings rates are approximately equal to average cancellation ceilings, but accrue faster to the government than does the average decay rate of the cancellation ceilings.

IV. FINDINGS, CONCLUSIONS, RECOMMENDATIONS

IV. FINDINGS, CONCLUSIONS, RECOMMENDATIONS

Approximately 40 historical MYPs ranging in dollar value from \$10M to over \$2B have been identified as having been executed during the 1962-1981 time period. These MYPs have occurred in all the services and two civilian agencies (U.S. Coast Guard, Maritime Administration) with a predominance of Navy and Army actions. MYPs have been used for the following kinds of commodity groups:

- . ships (e.g., SSN-688, T-AGOS, DD-963)
- . aircraft (e.g., RA-5C, USCG helicopters)
- . missiles (e.g., TOW)
- . torpedoes (e.g., MK-46 mod kits)
- . electronics/communications (e.g., AN/SLQ-32, AN/WSC-3)
- . tracked vehicles/trucks (e.g., M-109, 5-ton trucks).

Only one fixed-wing aircraft MYP program has been identified and no satellite programs have been verified as MYPs. Over 60% of the historical MYPs noted have been in ships and electronic/communications systems.

MYP historical savings accrued to the government have not been conclusively validated at the rates claimed in some quarters. It was not possible to fully document the frequently cited 10%-30% savings rate or the lower GAO postulated rate of 3%-8%. This difficulty stems from both the historical nature of the data and a lack of an acceptable model by which to judge the realism of quoted savings. A number of learning curve exercises used in the study indicate that 10%-15% savings from MYP are realistic. It should be emphasized that savings will vary as a function of the particular commodity group and financial structure of the MYP contract.

Based on the incomplete data contained herein, a historical cancellation rate of 14% is estimated. This figure is higher than the 1% rate commonly associated with cancellations in past studies.^{8,9} These studies have included MYPs for supplies and services and were not restricted to "major" systems; moreover, these past studies were based on MYP contracts in 1965, a time when MYP was just beginning to be implemented. The largest cancellation fee paid to date has been \$109.7M for the LHA, with the other fees ranging \$950K to \$15.3M. With one exception, the cancellations occurred in the last year of the MYP. The maximum cancellation fees paid by the government have been identified at 6% of total contract value. The cancellation ceilings have been between 1% and 26% of the total contract value in the first year with decreasing percentages over the years of the MYP.

In many of the MYP cases cited, cancellation ceilings were treated as contingent liabilities and therefore not funded. This situation has existed even when the cancellation ceilings exceeded the \$5M Congressional limitation. The Coast Guard and Maritime Administration have not funded cancellation ceilings based on existing and/or perceived guidance that civilian agencies should not fund contingent liabilities. A number of Navy comptroller organizations indicated that a "precedence" exists for partial

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funding of the cancellation ceiling. In these instances, Fixed Price Incentive (FPI) contracts were funded according to target prices rather than ceiling prices, indicating that the difference reflected an unfunded contingent liability. These three factors--successful use of past MYPs without full funding, civilian agency practice, and FPI funding practices--when linked to a 14% cancellation probability, indicate that partial funding is a realistic approach to wider MYP implementation.

The government, by virtue of the position it establishes in negotiating an MYP with a contractor, has the central role in the determination of the magnitude of the cancellation ceiling. This ceiling is composed of a nonrecurring cost and a recurring cost component. The recurring cost segment, primarily composed of economic order quantity (EOQ) purchases, can be adjusted on the basis of many parameters. This EOQ decision not only affects the cancellation ceiling but is the primary determinant of MYP savings. The government's funding policy and the funding profile used for an MYP are the primary determinants of the magnitude of the ceiling. While the data are incomplete regarding the determination of a rigorous "cross-over" point relating accrued MYP savings to potential cancellation losses, initial data indicate that MYPs will reach a break even point before the mid-point of the MYP contract term.

In spite of some of the notable Navy shipbuilding program problems, MYP should be implemented on a wider basis due to the potential for cost savings. Moreover, with a cancellation probability of 14%, partial funding of cancellation ceilings is a viable option. As noted in the report, there are numerous partial funding alternatives available to the government. Whether the Services or individual commands within the Services establish pools for all ongoing MYPs, or adopt some other partial funding approach which links the government's and the contractor's risks, the concept of partial funding is valid. MYPs for production contracts might be linked to those acquisitions having working Design-to-Cost programs during development because of the increased confidence in system unit costs. Existing DAR 1-322 guidance should be rewritten in the areas of level-priced MYPs and recurring cost as an allowable item of the cancellation ceiling to reflect the flexibility introduced by Congress in its 1982 legislation.

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APPENDICES

APPENDIX A

APPENDIX A

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22. "Request to Fully Fund Two Nuclear Aircraft Carriers in Fiscal year 1983"; March 26, 1981; Comptroller General of United States
23. "Review of Department of Defense Implementation of Procurement Reforms"; September 25, 1979, Comptroller General of United States
24. "Enhanced Multiyear Procurement for Improving Weapon Systems Acquisition"; Dr. A. Singer Col, D. Brabson, Summer 1982 Concepts
25. "Multiyear Procurement: A Current Perspective"; Mjr. R. Rasch, Mjr. J. Brearey, Spring 1982, Concepts
26. "Selecting Programs for Multiyear Procurement"; Lt. Col. K. Lajors, Spring 1982, Concepts
27. "Policy Memorandum on Multiyear Procurement"; May 1, 1981, Deputy Secretary of Defense
28. "Adapting to Multiyear Procurement"; Army Procurement Research Office; (APRU 81-10); May 1982
29. "Capability of U.S. Defense Industrial Base"; Sept. 1980, Committee on Armed Services, House of Representatives
30. "Analysis of Multiyear Procurements as a Department of Defense Procurement Technique", Catherine Cramer Davis, The Ohio State University, 1966
31. "Report of the Commission on Government Procurement", U.S. Commission of Government Acquisition, December 1972

32. "Multiyear Procurement, Two Step Formal Advertising, MIPR's", DOD Office of the Assistant Secretary of Defense for Installations and Logistics, June 1965
33. "Implementation Status: Multiyear Procurement", Logistics Management Institute, February 1965
34. "Limitations on Competition in Defense Procurement", Paul Cassaick, IDA paper P-1533

APPENDIX B

APPENDIX B
MYP INTERVIEWS

The following is a list of organizations contacted in the search for MYP data. These organizations provided general MYP information and specific data regarding savings, cancellations and funding policy. Also included are notes from a discussion with HAC staff members on MYP.

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OFFICE OF THE SECRETARY OF DEFENSE (OSD)

Deputy Secretary of Defense - Military Assistant
Deputy Secretary of Defense - Executive Assistant
USDR&E - Deputy Under Secretary (Acquisition Management) - Executive Assistant
OSD Assistant Secretary - Director of Procurement
USDR&E - Director of Contract Placement & Administration
USDR&E - Director of Major Systems Acquisition
Deputy Assistant Secretary of Defense - Administration
Deputy Assistant Secretary of Defense - Cost and Audit
OSD Washington Headquarters Service
OSD General Counsel - Assistant General Counsel (Logistics)

DEFENSE AGENCIES

Defense Logistics Agency - Executive Director For Contracting
Defense Logistics Agency - Executive Director for Contract Management - Termination Branch

OTHER GOVERNMENT

General Accounting Office
Congressional Budget Office
House Appropriations Committee (see attached text)

NAVY

US Navy Office of the Comptroller
NAVMAT
NAVSEA

- Office of Comptroller
- Assistant Deputy for Acquisition
- 02 - Contract Directorate
- 0261 - Undersea Warfare Systems Purchase Division
- 0262 - Undersea Warfare Systems Purchase Division
- 0265 - Undersea Warfare Systems Purchase Division
- 02 - Shipbuilding/Overhaul Contracts Division
- 933
- 901
- PMS - 389P
- PMS - 277T
- PMS - 377

NAVELEX

- Office of the Comptroller
- 2603
- PME-154

NAVAIR

- O2A Contract Management Directorate

ARMY

US Army Defense Acquisition and Readiness Command (DARCOM)
US Army Missile Command (MICOM)
US Army Missile Command - TOW Project Office
US Army Tank and Automotive Command - Tracked
Vehicles Systems Division

US Army Tank and Automotive Command - Logistics
Vehicles Systems Division

US Army Communications and Electronics Command (CECOM)

AIR FORCE

Air Force Institute of Technology, Wright Patterson AFB
Air Force Systems Command
Air Force Deputy Chief of Staff (DCS)

OTHER SERVICES

US Coast Guard - Contracts Directorate
Maritime Administration

COMMERCIAL

Advanced Technologies Incorporated
Northrop Corporation
Hughes Aircraft
Rockwell International
Honeywell, Inc.
Sperry, Inc.
Grumman Aircraft

ACADEMIC

Harvard University, Kennedy School of Government

On December 29, 1982, DSMC and Booz, Allen staff met with Messrs. Willson and Margleschetti to discuss multiyear procurement. In response to our introductory remarks, Mr. Willson stated that there are substantive differences between past multiyear procurements (MYPs) and the advanced MYP concepts being put forth today. He also made the point that people frequently label option contracts as MYPs, and that we should generally be sensitive to definitional issues. Mr. Margleschetti's opening comments reflected his view that commercial contractors wonder if MYP is a substitute or proxy for lack of a firm five year defense plan in DoD.

Mr. Willson initiated a discussion of the HASC viewpoint on MYP by stating that the Committee perceives full funding to be of paramount importance. He termed full funding as the appropriation of all funds for an MYP contract in the first year, recognizing that funds will be expended over a number of years. He identified full funding and incremental funding as being the two extremes in funding MYPs, with Congress leaning heavily toward full funding. Mr. Willson stated that the relaxation of full funding for long lead items was a push in the wrong direction, and that advanced MYP concepts leading to partial funding of Economic Order Quantity (EOQ) buys is a further push in the wrong direction. Mr. Willson indicated that HAC has three primary concerns over the DoD initiatives on MYP:

- . erosion of the full funding principles
- . exclusion of other acquisition strategies that save money
- . mortgaging the future by locking into major systems.

It was quite clear that Congress firmly supports the most conservative approach to MYPs in terms of financing.

At this point, both gentlemen noted that not all contractors are enthusiastic about MYP. They noted; however, that contractors are aware of the added stability of MYP programs and the benefits of not having to justify a program every year.

In response to our questions concerning the known benefits and/or penalties of MYP, Mr. Willson noted that savings are extremely soft in assessing MYPs. He stated that there were savings to be gained, but that past savings were not measurable in a believable way. Mr. Willson reiterated the GAO position that the only real way to document savings would be to require two sets of proposals (AYP and MYP), negotiate both, and see the resultant cost differences. He realized that this was both costly and impractical under traditional business practices.

In terms of the impact of MYP on the industrial base, both staffers mentioned the turnabout in DoD support for industrial base in the 1982 hearings relative to those of 1981. There appeared to be the feeling that DoD was using whatever arguments were expedient that year for further MYP implementation. The Army's Blackhawk helicopter MYP identified some concrete improvements to the industrial base according to the staffers. Mr. Willson suggested that other alternatives were available to DoD to upgrade the industrial base and save money, specifically, the use of dual sourcing. It was noted that major components for two Army tank programs (M1 and M-60A3 (??)) were dual sourced with reduced cost and an improvement in the industrial base. The Multiple Launch Rocket System (MLRS) was identified as another program where dual sourcing was compared to a sole-source MYP, with the final selection of an MYP being on somewhat tenuous grounds.

Mr. Willson reinforced his view that MYP is crowding out other viable acquisition strategies that offer advantages to DoD, e.g., dual sourcing, option contracts. He indicated that widespread use of MYP closes the door on the use of other strategies. Mr. Margleschetti cited the Navy's selection of four of its six aircraft programs as MYP candidates last year. He noted that if budget cuts were required in NAVAIR's APN budget, and these programs were MYPs, the F-14 and F-18 budgets would then be subject to cuts -- not an entirely desirable situation. Mr. Willson made the point that Congress is telling DoD to "slow down" on MYP, and that it may take three or four years for DoD to get the message.

Mr. Willson said that Congress was cautious on the use of MYP for major systems, but that the use of MYP for components of major systems would be an important initiative in the coming year. In follow up questions concerning PL 97-943 and its application in FY 83 and beyond, Mr. Willson stated that, "restrictions in the last bill are not satisfactory for MYP over the long term." He noted that changes would have to be made, but did not identify the nature of those changes. Mr. Willson called out three restrictions to the use of MYP:

- . any contract for a "major" system (per DoD 5000) can't be an MYP unless the law provides
- . any contract with EOQ procurements or more than \$20M in contingent liabilities can not be done without Congressional approval
- . all MYPs in the procurement appropriation accounts have to be identified in the P-1 Annex.

In answer to our suggestion that DoD might literally interpret this legislation as requiring identification of all MYPs (even \$10K supplies and services MYPs), Mr. Willson said that Congress' intention was not to go down to very low dollar thresholds. He recognized the possibility of a misunderstanding on this important issue.

Mr. Margleschetti noted that DoD had to do a better job prioritizing its MYP candidates, and thus facilitate the process of identifying MYPs for Congress. He cited the Navy's FY 83 aircraft MYP suggestions as being poor choices, particularly in terms of system quantities. He stated that small system quantities on an MYP were an indication to Congress that DoD had not thought out its choices properly. He further stated that "volume" (number of systems) is a key Congressional indicator. It was both staffers' contention that DoD and the Services need to prioritize better their system choices for MYP and don't leave the choice up to Congress.

In response to a number of brief questions, Mr. Willson stated that he was not aware of any differences in funding policies for DoD versus other civilian agencies. He further noted that he had never really thought about it, and there may, in fact, be differences. Mr. Willson was not aware of a centralized MYP data base or other historical MYP contracts as appropriate to our study. He was not aware of any cancellations other than the LHA. Mr. Willson responded to a question over the relationship between low cancellation probability and less than full funding by stating that no relationship existed. At this point, he recalled to us that full funding is the guiding principle regardless of savings, cancellation probability, and other MYP nuances. Full funding clearly demonstrates to Congress the ultimate cost of weapon systems and is highly desirable on that basis.

Mr. Willson stated that outlays would not necessarily be changed or delayed under full funding, but agreed that higher "unobligated balances" are created. He eventually agreed that outlays would be delayed slightly under fully funding. In his closing remarks, Mr. Willson noted that MYPs may be as difficult to cancel as to modify upward in terms of quantity.

APPENDIX C

APPENDIX C

TERMINOLOGY

The list of Multiyear Procurement terms provided here includes the most commonly used terms and the most generally accepted definitions. They are grouped into two categories: acquisition terms, and financial terms.

ACQUISITION TERMS

Multiyear Contracting is a method of acquiring more than 1 but not more than 5 years of requirements under one contract. Each program year is budgeted and funded annually. At the time of award, funds need to have been appropriated for the first year only. The contractor is protected against loss resulting from cancellation by contract provisions that allow reimbursement of cost not to exceed in the cancellation ceiling. Multiyear contracting is not total-package procurement. Total package procurement included development and production phases, whereas MYP applies to production and services only.

Single-Year Contracting (annual buys) refers to the method of acquiring 1 or more year's requirements (even though deliveries may extend over several years) through the use of separate contracts or through separately priced options on a single-year contract.

Cancellation is a term unique to multiyear contracts. A cancellation is the unilateral right of the government to discontinue contract performance for subsequent fiscal years' requirements. Cancellation is effective only upon the failure of the government to fund successive fiscal year requirements under the contract, or failure to put money on the contract by the time called for by the contract. It is not the same as termination. A termination would occur if current fiscal-year requirements were discontinued, or if a cancellation were effected despite funds being available. A contract cancellation clause must be included in multiyear contracts.

Cancellation Ceiling is the maximum amount that the government would pay the contractor for recurring and non-recurring cost (and a reasonable profit thereon) in the event of contract cancellation. The amount actually paid to the contractor upon settlement for unrecovered costs (which can only be equal to or less than the ceilings) is referred to as the cancellation charge.

Non-recurring Costs, related to multiyear contracts, are production costs that are generally incurred on a one-time basis and amortized over the entire MYP production quantity. They include such start-up costs as plant or equipment relocation; plant rearrangement; special tooling and special test equipment; preproduction engineering; initial spoilage and rework; specialized work-force training; and unrealized labor learning, which is the unrecouped portion of a projected learning curve. Non-recurring costs may be included in cancellation ceilings.

Recurring Costs, related to multiyear contracts, are production costs that vary with the quantity being produced, such as labor and materials.

Termination, contrasted with cancellation, can be effected at any time during the life of the contract. Cancellation is only effected if funding for the second or later years of the MYP is not received. Termination can be for the total quantity, or a partial quantity, whereas cancellation would be for all subsequent fiscal years' quantities. A termination can apply to any government contract, including a multiyear contract.

Termination Liability is the maximum cost the government would incur if a contract were terminated. In the case of a multiyear contract terminated before completion of the current fiscal year's deliveries, termination liability would include an amount for both current-year termination charges and out-year charges.

Advance Buy Procurement is an exception to the full funding policy. An advance buy, or advance procurement, is the acquisition and financing of components, both recurring and non-recurring, in a fiscal year in advance of that in which the related end item is to be acquired. Advance-buy financing may be used to cover the costs of materials, parts, and components for subsequent years as well as costs associated with the further processing of those materials, parts, and components.

There are two categories of advance buys. The first includes the traditional type of item that is bought early to protect an overall delivery schedule. The second type includes items bought in advance simply to obtain savings. It is worth noting that the definitions are not mutually exclusive. An item could be purchased to protect schedules, and at the same time be bought in economic lot quantities that include 4 years' worth of requirements in order to save money. Advance buys can be part of a multiyear contract or a single-year contract.

Block Buy is a method of acquiring more than 1 year's requirement under a single contract. A total quantity is authorized and contracted for the first contract year. A block buy is a type of MYP and is funded to the termination liability.

FINANCIAL TERMS

Multiyear Funding involves a congressional appropriation covering more than 1 fiscal year. Congress is not now appropriating funds more than 1 year at a time. That is, they do not appropriate FY 83 funds in FY 82. Multiyear funding is not synonymous with multiyear contracting. The terms should not be confused with 2-year or 3-year funds (called multiyear appropriations), which cover only 1 fiscal year's requirement but permit the executive branch more than 1 year to obligate the funds.

Full Funding is the congressional obligation authority (OA) for fully financing any quantity of end items in a single fiscal year. It is implemented by DODD 7200.4. Currently DODD 7200.4 authorizes an exception to full funding-advance buys to protect schedule. An additional exception is expected to authorize advance buys to obtain savings. Under full funding,

funds are to be available at the time of contract award to cover the total estimated cost to deliver a given quantity of items or services. The entire funding needs of the fiscal year production requirements are provided unless an exception for advance procurement is used. A test of full funding is to ask the question, "Does any part of this year's buy depend on a future year appropriation to obtain delivery of complete units?" If the answer is yes, the contract is probably not full funded. The principle of full funding applies only to the procurement title of the annual appropriation act and therefore affects production contracts but not RDT&E contracts.

Termination Liability Funding refers to the method of obligating sufficient contract funds to cover the contractor's expenditures plus maximum termination liability, but not the total cost of the completed end items. Funds are designated for specific increments of work to be accomplished during the fiscal year for which the funds are approved. Increments of work are based on economic production considerations of the total end items on contract but are generally not segregated to a specific subset of the total quantity. This concept has only limited applications to production type programs and should be considered as an exception to normal procurement financing. Funds are not available at the time of contract award to complete and deliver a quantity of end items in a finished, military, useable form. Funding to termination liability is commonly done in RDT&E programs. There are two types of costs covered by this method of funding. The first is the contractor's expenditure and the second is the not-to-exceed amount of termination costs that could be incurred if the contract were terminated. In the event that a contract were terminated, the total cost liability would be covered.

Under Incremental Funding, funds are appropriated, obligated, or committed in a piecemeal manner rather than all at once. This term is commonly used to mean "funding to termination liability" when used in conjunction with RDT&E funds.

Expenditure Funding involves funding to the contractor's expenditures. The termination costs are not included or funded using this approach. If a contract were terminated, additional funds would be necessary to cover the termination costs.

In an Incrementally Funded Block Buy, a production program for the MYP is authorized in the first year. Funding is provided annually at the termination liability level.