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# DEFENSE SYSTEMS MANAGEMENT COLLEGE



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## PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

The Impact of  
Independent Cost Analyses  
on DOD Acquisition Management

STUDY PROJECT REPORT  
PMC 77-1

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Major USAF

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THE IMPACT OF  
 INDEPENDENT COST ANALYSES  
 ON DOD ACQUISITION MANAGEMENT

Individual Study Program  
 Study Project Report  
 Prepared as a Formal Report

Defense Systems Management College  
 Program Management Course  
 Class 77-1

by

John Eugene Wrobel, Jr  
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May 1977

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This study project report represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management College or the Department of Defense.

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE: THE IMPACT OF INDEPENDENT COST ANALYSES ON DOD  
ACQUISITION MANAGEMENT

STUDY PROJECT GOALS:

To identify the impact of Independent Cost Analyses on (1) estimated program costs and (2) behavior of acquisition managers.

STUDY REPORT ABSTRACT:

The purpose of this study was to review the impact of the DOD policy requiring Independent Cost Analyses (ICA). The study consisted of interviews with selected acquisition and cost analysis managers as well as a review of the current literature, including US General Accounting Office reports.

Increased system costs have been attributed to poor cost estimating. Since the inception of ICAs, cost growth has been reduced. This reduction would seem to result from the increased emphasis on cost estimates directly related to the high visibility given to the ICA.

The study concludes (1) the program manager can use the ICA to offset stresses inimical to his program, and (2) notwithstanding the continued need for better estimating, major improvements in cost control will now have to come other areas of management.

SUBJECT DESCRIPTORS: Cost analysis, Cost Analysis Improvement Group (CAIG), Cost estimates, Cost growth, Parametric estimate, Program ICE, Selected Acquisition Reports

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## EXECUTIVE SUMMARY

Independent Cost Analyses (ICA) are cost estimates made outside the advocacy chain, normally using parametric techniques to project future costs. The purpose of this paper is to examine the impact on acquisition management of the DOD policy requiring ICAs.

For many years, Congress expressed concern about increases in the cost of weapon systems which it attributed to poor cost estimates. In 1971, DOD directed that ICAs be presented on every program meeting a Defense Systems Acquisition Review Council.

Once established as a check on the reasonableness of program estimates, the ICA began to influence cost estimating throughout DOD. Methods and data for conducting parametric estimates were improved.

On the surface, the ICA process may seem to cause conflict with program managers, but it actually can be used to offset pressures adverse to the program.

Although further improvements in cost estimating can be made, major advances in cost control will now have to come from other areas of management.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY	ii
1. INTRODUCTION	1
Purpose	1
Scope	2
Summary	3
2. EVOLUTION OF THE DOD POLICY ON INDEPENDENT COST ANALYSES (ICA)	5
Congressional Scrutiny	5
Developing a Policy	8
The Policy	9
Cost Analysis Improvement Group	10
Design-to-Cost/Life Cycle Cost	11
3. THE ROLE OF ICAs IN ESTIMATING PROGRAM COSTS	13
Cost Estimating and Decisionmaking	13
Parametric Estimates	15
Informal Influences	16
4. PERCEPTIONS OF ACQUISITION MANAGERS ON ICAs	20
Impression of Conflict	20
The Record	20
Useful Assistance	21
A Recommended Change	22
5. CONCLUSION	23
Paradox	23
Other Problems	24
Future Efforts	24
APPENDIX A: Cost Growth Data	26
BIBLIOGRAPHY AND LIST OF REFERENCES	34

## CHAPTER 1

### INTRODUCTION

1794

Congress authorized the building of six large frigates which were to form the backbone of the U.S. Navy. The War Department was assigned the task of acquiring the ships. Nearly 17 months later, the six keels were laid. Shortly thereafter, due to delays and cost overruns, the program was cut back to three ships.

1977

Because of inflation, changes in schedules, engineering and quantity, and mistakes in estimating costs, the 147 weapon systems the Pentagon has under development and in production will cost 43% more than originally estimated, an increase of \$74 billion (9:7).

#### Purpose

The results of this twentieth-century overrun will probably not be much different from that of the eighteenth century. In order to stay within budget ceilings levied by Congress and the President, the Department of Defense (DOD) will have to slice programs. Most probably no programs will actually be killed. Rather many programs will be reduced in quantity or performance regardless of the original justification (20:17, 28:19, 31:21). For example, the F-14 program originally included 710 airplanes with a price tag of \$6.2 billion. It is now reduced to 403 airplanes costing \$8.7 billion (9:7, 34:95). In this sense, cost overruns are dangerous to national security as planned defense capabilities are cut to keep within the budget.

The purpose of this paper is to review the impact of one DOD policy for controlling costs: independent cost estimating, specifically the Independent Cost Analysis (ICA) process. In

his testimony to Congress on the Fiscal Year (FY) 1978 budget, Dr. Malcolm R. Currie, Director of Defense Research and Engineering (DDR&E), listed independent cost estimating as one area being stressed by DOD: "We are developing this discipline in the Services and it is leading to more realistic prediction of program costs at their inception (59:I-10)."

#### Scope

This paper is limited to the DOD policy requiring ICAs at specific major decision points during development of a weapon system (52:1, 46:1, 47:1-3). All along the route from initial idea to system development, choices must be made that will significantly impact on the ultimate costs. If the Services are to achieve sound financial control of costs, it is essential that they have sound and reliable estimates of the cost implications of their choices (5:153). While all cost estimating is based on interpretations of observed historical phenomena to reflect the future, ICAs are special estimates prepared outside the normal advocacy channels to test the reasonableness of an official program office estimate (45:4).

An ICA uses cost estimating techniques different from those used to prepare the official program estimate. It differs from an Independent Government Cost Estimate (IGCE) in that the IGCE is developed primarily by the program office to check the contractor's estimate and support the program budget formulation (47:5-2). The ICA is primarily developed independent of the program office, although the program office plays a vital role in supporting the ICA team.

To the extent that costs grow, program decision criteria are vitiated. To the extent that program decisions do not consider potential cost growth as a criterion, they are poor decisions. Not all cost growth can reasonably be prevented, at least not without major changes to federal procurement procedures. Unusual periods of inflation may result in cost growth. Changes in technology may make possible modifications resulting in increased system effectiveness. Such growth cannot be anticipated, particularly when a system is in development and production over long periods (28:19, 31:21). Nevertheless, the purpose of cost estimating is to produce reliable criteria for decisionmakers at all levels (1:xi, 24:1, 61:154). Experience has shown that independence is an essential requirement if reviews of future costs are to be valid at the Defense Systems Acquisition Review Council (DSARC) (10:21). This paper addresses the impact of the formal requirement for this independence.

#### Summary

For many years, Congress has expressed a concern, even dismay, over the increased costs of weapon system acquisition. In response to this and to its own internal management desires, DOD directed in 1971 that an ICA be presented at each DSARC meeting as a test of reasonableness of the program estimate. A Cost Analysis Improvement Group (CAIG) was established to advise the DSARC on the validity of the ICA.

Once established as a check on program estimates at the DSARC level, the ICA began to influence the cost estimating discipline

throughout DOD. Although it can be conducted by any of a number of techniques, the CAIG encourages the use of parametric estimates for ICAs and developed means for gathering actual historical cost data.

On the surface the ICA process may seem to cause a conflict with program managers, but it actually can be used to their advantage to offset pressures adverse to the program.

Despite the demonstrated improvement in cost estimates since inception of the ICA, criticism of DOD management continues. Although further advances in cost estimating are needed, major improvements in cost control will now have to come from other areas of management.

## CHAPTER 2

### EVOLUTION OF THE DOD POLICY ON INDEPENDENT COST ANALYSES

One key element in managing Defense programs is the ability to prepare realistic estimates of the most likely cost of a system. In this regard, the DOD has come to rely on "independent" cost estimates prepared within the Military Departments and by the Cost Analysis Improvement Group (CAIG) within the Office of the Secretary of Defense for such projections. The "independent" features of these estimates insures that they are more than simple advocacy expressions and a proper basis for establishing...goals and thresholds.

- Dr. Malcolm R. Currie (59:IX-11)

#### Congressional Scrutiny

For many years Congress has demonstrated concern and dismay over the increased costs of weapon system acquisitions. (Table 1 indicates the extent of this growth.) Part of this

TABLE 1

#### Growth in DOD Budgeted System Costs

	<u>1956</u>	<u>1966</u>	<u>1976</u>
Procurement Outlay	\$1.5B	\$6.3B	\$9.0B
RDT&E outlay	\$1.4B	\$2.3B	\$4.8B
Total DOD budget	\$40.6B	\$58.5B	\$90.9B
Percent of federal outlay	58%	43%	25%

Reference 14:74

Congressional reaction reflected confusion on the nature of weapon system acquisition by some members of Congress. Cost increases regardless of the cause (inflation, Congressional direction) was considered to be cost growth attributable to poor DOD management. In the 1968-1971 period, emphasis on poor cost estimating increased (Table 2): program cost estimating had been

TABLE 2

Congressional Concern for Cost Estimating

The following comments were extracted from hearings before Congressional committees during 1968-1971 (61:287).

Cost estimating too widely credited with accurate predictions, precise problems not foreseen; affects DOD credibility; of critical importance

Experts say cannot estimate with better than 30% accuracy; no counterpart problem in industry; height of folly to pretend one can estimate production 5-7 years later

Constantly being assailed by critics for firm figure; inability to explain, affects public confidence; political, economic, technological changes impact severely

Cost estimates consistently overoptimistic; system pressures, motivation creates bias; is basis for overruns; must improve

Economic instability major problem; excessive inflation and cost escalation contingencies; over time, ships estimates come within 2%, Congress did not make requested funds available

Parametric cost estimating offers potential, but limitations must be acknowledged; heavy reliance raises question of adequate policy

Need statement of precision; need confidence in estimates; only gross estimates are possible initially

Methodology must be improved, but some feel has reached limits of capability; some improvement in application possible

Cost analysts' capabilities must be upgraded; more coordination, interchange between services needed; overall training in use of cost data required

Need more extensive, uniform cost data, cost data bases; present system is new; development is long-term proposition

Root problem not understood; new high-level, cost analysis groups not answer; independent cost estimates only partial check

Must look for alternative means of improvement; Congress must insist on cost realism, detecting underestimates difficult; cost can only be determined by building device

credited with far greater accuracy than it merited and this created misunderstanding and communications problems (61:153-154). In 1969, Congress asked the United State General Accounting Office (GAO) to report periodically on the progress and status of various system acquisitions. Since 1970, the GAO has issued annual or semi-annual reports based upon data contained in the DOD Selected Acquisition Reports (28:1). (See Appendix A for a discussion of these reports and a summary of GAO data.) It has also since issued ad hoc reports on various aspects of DOD weapon system acquisition management. (See the Bibliography for a sample.) The GAO has consistently stated that overly ambitious performance requirements, combined with low initial cost estimates and optimistic risk estimates lead almost inevitably to schedule slippages, performance degradation and cost increases. In turn, these lead to reduction in planned quantities and increased unit costs. (28:22, 29:ii, 31:24). In 1972 the GAO reviewed DOD cost estimating and found difficulties resulting from poor cost estimating documentation and collection of data. It recommended an effective independent review of cost estimates, including judgement by top officials as to the realism of the cost estimate on which a decision was based (24:1-2).

As late as 1977, the GAO testified to the Subcommittee on Research and Development, House Armed Services Committee: "There is still a consistent underestimation of risk and cost, and this always seems to result in tradeoffs of quantities and performance capabilities later on in the program and stretchouts (60:9)."

The GAO recommended (1) the Secretary of Defense should rely on more independent estimators to prepare second opinions on the costs and benefits of various programs (9:7) and (2) Congress should continue to support, possibly strengthen, a very strong and independent cost analysis capability within the Office of the Secretary of Defense (60:9).

#### Developing a Policy

The DOD has had a policy of using a cost estimate separate from the contractor's estimate since the early 1960s (4:35). In 1969, DOD established the "best estimate" policy which would reflect ultimate amounts to be paid, including economic factors. However, a 1971 Logistics Management Institute report commissioned by the Assistant Secretary of Defense (Installations and Logistics) concluded "...initial time and cost estimates - and even updated estimates - cannot be depended upon...(Ref. 23 quoted at 5:4). In fact, there was some evidence in 1971 that DOD was attempting to reduce cost growth by raising estimates as a matter of policy: each organizational level added a little to avoid criticism for cost growth (5:167 but see 22:161 for opposing view).

During this period, two studies looked at the DOD policy on cost estimating as a means of improving management. The Blue Ribbon Defense Panel concluded:

Studies reveal that on the average, cost estimates on major systems development have probably improved in relative accuracy over the past fifteen years. So many variables affect the evaluation of cost estimates, however, that confidence in such a conclusion must be qualified. In any event there is much room for improvement (56:83).

It recognized that factors other than technological uncertainty contribute to inaccuracies of cost estimates, for example, understandable incentives to sell a development program to the Secretary of Defense and Congress. It concluded that the most fundamental problems of cost estimating could not be resolved without acknowledgment of the inherent limitations of cost estimations for development programs - the original estimate should be considered only a baseline to be revised as more knowledge is obtained (56:84). A later study by the DSARC Cost Reduction Working Group (also known as the "Little Four") concluded (1) most so called cost growth is the direct or indirect result of low initial cost estimates, and (2) much more realistic estimates are possible (63:7,12).

#### The Policy

In December 1971, the Deputy Secretary of Defense published a memorandum, "Use of Parametric Cost Estimates," directing an independent parametric cost analysis be incorporated in each DSARC presentation as of 7 January 1972. Shortly thereafter, the Secretary of Defense directed each Service Secretary to create a staff component capable of preparing independent parametric cost estimates, separate from program proponents (52:1). The general purpose of this independent cost estimate, soon to be called an Independent Cost Analysis (ICA), was to provide a test of reasonableness of the program cost estimate (47:5-4).

This policy of requiring ICAs for each DSARC has now been integrated into the defense acquisition process (37:7, 38:12,13, 16,17,19) and applied by OMB to the entire executive branch:

Each agency acquiring major systems should...maintain a capability to predict, review, assess, negotiate and monitor costs for system development; assess acquisition costs...and provide such assessment for consideration by the agency head at key decision points; make new assessments where significant cost, schedule or performance variances occur; use independent cost estimates, where feasible, for comparison purposes...(57:5).

The policy was formalized with the creation of the Cost Analysis Improvement Group (CAIG).

#### Cost Analysis Improvement Group

Established in January, 1972, the CAIG function is to review and interpret for presentation to the DSARC principals, the program manager's estimate and the Military Services independent cost analysis. The review is intended to improve the quality and credibility of DOD weapon system cost estimates (10:20, 38:12, 39:2, 42:4). The existence of the CAIG was formalized in June 1973 with the issuance of a charter (ref 39) giving the CAIG specific responsibilities for (10:20, 39:2):

- 1) program cost reviews in support of DSARCs;
- 2) DOD cost analysis policy and guidelines; and
- 3) DOD cost data collection and retrieval system.

The CAIG is functionally located under the Assistant Secretary of Defense (Program Analysis and Evaluation) (42:5) and consists of a chairman, one representative appointed by each DSARC principal, and one member from each of the Military Departments (10:20, 39:1). It meets before each DSARC and provides its evaluation of the cost estimates to the principals at least 5 days in advance of the DSARC meeting.

The importance of the CAIG has not been the number of re-

views it conducted - there were 29 DSARC reviews conducted in 1976 (59:IX-6) - but the extent to which the depth of discussion and understandings of cost estimates at DSARCs have been intensified since its creation. The Service ICA plus the CAIG review have exerted significant pressures on program managers to develop more realistic cost estimates (10:21). While difficult to demonstrate quantitatively, imposition of ICAs appear to have significantly contributed to removing cost estimates from the realm of simple advocacy expressions (10:24, 59:IX-11). Certainly, the reputation of the CAIG has enhanced DOD's credibility with Congress.

#### Design-to-Cost/Life Cycle Cost

Another way in which the ICA has been formalized in DOD management is through its contribution to Design-to-Cost (DTC) and Life Cycle Cost (LCC) philosophies. Dr. Currie attributed much of the improvement in controlling costs to better management resulting from DTC/LCC: 69 programs are now in various stages of DTC, with 35 having firm goals (59:IX-12). The CAIG formally reviews DTC goals and advises the DSARC of their achievability (40:4). Recent reviews have begun to emphasize operating and support costs as well as acquisition costs, and the CAIG is responsible for providing a framework in which the Services can accumulate actual operating and support cost data (10:23, 16:11, 36:11; see the Bibliography for selected references on the role of good cost estimating in DTC/LCC).

The ICA is now firmly ensconced in the acquisition process. Next, its role as a leading factor in cost estimating will be

considered.

## CHAPTER 3

### THE ROLE OF INDEPENDENT COST ANALYSES IN ESTIMATING PROGRAM COSTS

One of the major factors in cost overruns has been irresponsible low estimates at the beginning of a program. "Buy-ins" by contractors have been a big element of this irresponsibility. Another contributing factor has been the attempt to price out a full program before the new weapon is developed...The record is nothing anyone can be proud of.

- David Packard (11:4)

One senior appointed DOD official said, "We have seen the problems of underestimating and the problems of overestimating, and I believe that the penalty for overestimating is less in the present environment. We had better be safe than sorry on estimates." (5:168)

#### Cost Estimating and Decisionmaking

When a system is proposed, a paramount question to be answered is whether the total price to be paid by the Government is too high. Normally, the benefits derived from initiation of a new program are readily apparent (if not exactly quantifiable), but estimating the cost is the basic problem. Often the inherent limitations on cost estimates resulting from technological uncertainties cannot be completely overcome. Optimism slants the result because we want the system and really do not know the right answer (19:40, 56:83). Additionally, there is a natural pressure for contractor and DOD estimates to reflect the level of funding officials believe would be appropriated by Congress (5:158). Therefore, a critical weakness in the system acquisition process is the inability of both contractors and DOD to estimate system costs.

Underestimation is definitely perceived as the most significant problem. Low bids are accepted by DOD in the belief that costs will be lowest when a contract is awarded to the competitor whose initial bid is lowest. Cost growth may occur, but it is assumed it will be less than if a higher bid was accepted. However, it has been suggested that low estimates themselves actually contribute to cost growth (20:2-10). Some reasons given are that abnormally low cost constraints cause irrational decisions, lack of innovation, insufficient testing, undue economizing on engineering hours, program stretchout, poor production design, and increased Government surveillance - all of which add costs to the final product. The overall effects of underestimating go further, though, than just cost increases. Underestimating results in requirements not being fulfilled even at increased costs; future planning becoming unrealistic; unbalanced, wrong alternatives being chosen; and credibility decreasing in the eyes of Congress and the public.

On the other hand, it is easier to blame an initial low estimate than it is to establish effective program controls, disapprove additions and admit to failures in management. One must be courageous and perhaps even foolhardy to take a hard look at the reasons for cost growth. Nevertheless, if one accepts the reasoning on low estimates, the solution appears simple: increase the initial cost estimates. The trap is sprung! Contractors learn of the higher budgeted cost and raise the cost to the budget in an endless spiral (5:165). This dilemma has been organizationally answered by the functionally simple ICA process rely-

ing principally on parametric estimates.

#### Parametric Estimates

Parametric cost estimates are derived by extrapolating costs for a given system from the actual costs of previous systems and correlating these costs with physical or performance characteristics of the systems (47:5-4, 5:156). They are based on statistical relationships at an aggregate level within the system. While parametric techniques are not the only way of developing independent estimates, the CAIG encourages their use because they capture the cost of setbacks and design changes encountered by almost all programs - costs not usually anticipated in an engineering or "grass roots" approach. An ICA does not have to be based on parametric techniques but they are particularly useful in checking the reasonableness of the goals and thresholds used to manage systems acquisition (10:23).

Parametric estimates are not without their critics. Since parametric estimates are based on the actual cost of previous systems they can be no better than the historical data used as an input. Unfortunately, the majority of defense system cost records have not been derived from programs competitively awarded or effectively controlled (5:156, 164; 61:156)...and this does not even consider the accuracy of the documentation of the actual costs. There is an implicit assumption that no greater efficiency and control will occur in future systems than occurred in past systems, and that all of the problems on past systems will occur again on the new program. A. Ernest Fitzgerald, the former Air Force official who highlighted the extent of

overruns on the C-5 program to Congress, sees parametric estimates as the ratchet in the mechanism for jacking up prices, which is being turned by DOD cost Calvinists who believe large costs on weapon systems are preordained (4:41). He would hope that the historical data could be scoured of inefficiencies, waste and redundant expenditures (4:34). Unfortunately, the CAIG data bank is not detailed enough to eliminate these obviously negative factors.

The primary answer to the criticisms is that parametric ICAs have never overestimated any program, even though the ICA is not used for budgeting purposes. (Budgeted funding levels are determined by the program office and Military Services and are lower than parametrics for all major systems.) In reality, the parametric is primarily a decision tool used to determine whether DOD could absorb anticipated higher costs if the program office estimate were breached.

Parametric cost estimates are not statements of facts but rather a judgment of the cost of work to be performed under certain specified conditions (5:154). Precise quantitative estimating techniques do not lessen the need for good judgment (47:1-2). Viewed realistically, parametric estimates are a useful means of handling limited information to provide "ballpark" estimates. They provide an understanding of factors influencing costs and act as a healthy check on more detailed program estimates (64:34).

#### Informal Influences

In general, cost estimates are required for four types of

activities in the acquisition process (45:1, 5:154):

- 1) for planning purposes
- 2) for budget preparation
- 3) for pricing contracts and contract changes, and
- 4) for progress measurement and control of ongoing programs.

ICAs, however, are used formally only as an independent check of the reasonableness of a program office estimate. In general, the Service ICAs and CAIG reviews are more conservative than the program office estimate. The result has been higher program estimates despite the program office's and contractor's obvious self-interest in predicting lower costs and assuming more money will be forthcoming once the program is started (20:14, 17). One would hope the results are more accurate, but in any case, the ICA provides feedback to the program office and helps it fine tune its own estimate.

While ICAs per se are not used for planning and cost-effectiveness studies, they have been used as an input into choosing between alternatives within a constrained budget. For example, the recent B-1 study showed the system to be cost-effective even at the higher ICA estimate. To the extent that ICAs produce a ballpark estimate, they contribute to the credibility of DOD planning (20:17). (The weakness of DOD cost-effectiveness studies has been studied by the GAO (Ref 25, 29, 35). Recommendations included establishing an independent review of cost-effectiveness studies similar to the CAIG review of costs (29:15, 35:64).)

The emphasis on costs and cost estimating created by ICAs

has resulted in better cost estimating models, data banks, documentation, and most important, trained people. Adequate cost-estimating capability depends on the availability of good people making good estimates (5:154). The ICA provides incentives for cost estimators to improve performance concomitant with the increased visibility. It also acts as a lure to draw good people into the cost estimating discipline who would otherwise look elsewhere for challenges and rewards.

The GAO is in the process of recommending that decision-makers in the Executive Branch and Congress require cost estimates with a range of probable costs instead of a point estimate. The development of a range of costs for a program, while not eliminating the uncertainties, will highlight major areas of probable risk and uncertainty along with the cost impact should they occur. The revised DODD 5000.2 specifically allows cost goals to be less than firm up to full-scale engineering development (38:16,17). The ICA based on parametric techniques would easily accommodate this recommendation within the DSARC process.

ICAs are not used directly as an input to the Planning, Programming and Budgeting System (PPBS). DOD will not issue a Program Budget Decision authorizing funding at the ICA level per se. (This may be true even if the program office accepted the ICA in its entirety as its own estimate.) While the DSARC recommends to the Secretary of Defense that he authorize continuation of a program, funding requests must come from outside the DSARC/ICA chain (38:8). Nevertheless, since Air Force ICAs are conducted by the Comptroller, he is made aware of how

much the program is likely to cost. (Conceivably, if the ICA estimated the program cost to be less than the budget estimate, the Comptroller should not withdraw funds, but ...)

As can be seen, the ICA has more influence than its formal function would indicate. Next, the overall impact of the ICA will be considered.

## CHAPTER 4

### PERCEPTIONS OF ACQUISITION MANAGERS ON INDEPENDENT COST ANALYSES

Except for a small number of people in the Pentagon and the defense industry, appraising the reasonableness of a cost estimate for a new complex program is like estimating the number of fleas on Manhattan Island. You know the number is high, but you don't have any idea how high (5:160).

#### Impression of Conflict

There is probably no problem more frustrating and more basic to program managers than cost estimating. Control of the total costs of our weapon systems is probably the most difficult management job in the Department of Defense (63:1). Because of this difficulty, program managers - having some pride and self-confidence - often are reluctant to accept the ICA process. They dislike someone from a functional staff looking over their shoulder and feel there is too much potential for an ICA to make the program (and program manager) look bad. Higher program officials are also uneasy about raising the ICA flag for all to see up to the DSARC. The aggressive program managers would like to have their own cost estimating capability and not open themselves to outside experts. On the surface, the ICA process causes conflict that may be avoidable.

#### The Record

In reality, it is the ICA which is open to challenge at every step along the way. Each ICA has a rather complete set of required documentation (46:4). It must include details on its sources and data as well as methodology. Its cost estimates are

challenged at every level from the field organization through the CAIG (46:3). On the other hand, the program office estimate is generally not reviewed except as to the amount - nothing about documentation, sources, data and methodology. If there is a difference between the ICA and program estimate, it is the ICA leader who must explain.

Secondly, no program has yet been killed because of an ICA. (Actually, no program has been terminated by the DSARC for any reason (60:15,22).) In most cases, programs with large differences between ICA estimates and program estimates are subjected to further review, quantity reductions and schedule stretchouts (for example, see the annex to ref 63). This may be due to the fact that programs with major difficulties are modified in the process leading up to the DSARC and the fact that the CAIG review of the ICA eventually convinces the Service to make program changes.

#### Useful Assistance

The ICA provides the program manager with assistance in two ways: the process provides 1) the discipline necessary to make better estimates, and 2) the leverage to challenge contractors and higher headquarters budgeteers. By drawing upon the additional introspection created by ICA, the program manager can develop an estimate which will more accurately assure adequate resources in the DOD Five Year Defense Plan. Very often the contractors and higher Service organizational levels combine to keep the program estimate low (5:160-162). ICAs provide a positive "adversary" relationship and threat of detailed review

which can be used by the program manager to his advantage.

A Recommended Change

Notwithstanding the value of the ICA and the ICA process, several acquisition managers recommended one change. While agreeing that ICAs are necessary and that the CAIG should continue to review them prior to DSARC, they suggested that the ICA and budget estimate be combined into the "best" estimate. The purpose of the ICA is to check the reasonableness of the program estimate. This can be done by the Comptroller or other functional office as it is done now. The estimate would still be independent of the program office. Sufficient details on methodology, documentation, and data could accompany the best estimate and be reviewed by the CAIG as a check of reasonableness. Most certainly, this would require greater discipline in setting budget priorities among programs; budget cuts would not be permitted without related reductions in quantity or performance. Stronger management of contractor costs would have to be undertaken by program offices and plant representatives to prevent estimates from becoming "self-fulfilling" prophecies. (4:57).

## CHAPTER 5

### CONCLUSION

In 1974, Mr. Leonard Sullivan, ASD (PA&E), reported the last 36 programs to reach production missed planning estimates by factor of 2.4 and development estimates by 1.5 - and this includes all DOD-favoring corrections for inflation and quantity changes. "As this track record goes...so goes our Defense credibility (63:19)."

#### Paradox

Dr. Malcolm R. Currie, DDR&E, reported different results in his testimony to Congress in 1977: 6.4% annual cost growth in 1972, 4% in 1975 and 3% in 1976 adjusted for escalation and quantity (59:I-9). The extreme difference between Dr. Currie's figures and Mr. Sullivan's illustrate the confusion about DOD cost growth which has led to a lack of credibility and cries of poor management. (In fact, the numbers are reconcilable but it takes sophisticated reasoning.) Likewise, false initial cost estimates and buy-ins are not really cost overruns that necessarily represent real waste, but they ensure that a program will look like money has been wasted. The defense community will continue to look stupid until and unless this situation is corrected (11:4).

Claims of weapon system acquisition cost growth two and three times the original baseline estimates was a factor leading to the creation of the CAIG and the requirement for ICAs at DSARC milestones (10:20). This emphasis on better cost estimating has resulted in demonstrated better control of costs but individual programs still provide ripe targets. The 1970 estimate for the

F-15 was \$7.4B; the 1978 estimate was \$12.6B. The 1970 estimate for the B-1 was \$9.9B and the 1977 estimate was \$22.8B. During a recent CBS news special, Senator William Proxmire highlighted the B-1 increase and stated, "No increase in cost indices can explain the increase in the B-1 (ref 58)." In fact, inflation estimates accounts for 70% of the F-15 cost increase and 64% of the B-1 (34:93).

#### Other Problems

There are other problems. The "heavy and regular use of reprogramming by the Pentagon, amounting to billions each year, emphasizes that the defense budget is anything but firm (3:98)." Despite increased credibility with Congress resulting from the CAIG, there is still a suspicion that DOD is hiding cost overruns (60:34). When this is added to the fact that DOD must submit requests for authorizations at least 16 months in advance of the fiscal year, track the estimate through the second budget review, and explain the difference, cost estimates will continue to differ by some amount from actual costs (8:2). The effect of a zero-based budgeting is still unknown (6:124).

#### Future Efforts

Without disputing the need for better estimating, data (Appendix A) suggests additional estimating reforms are not likely to reduce underlying problems in system acquisition costs. The relative simple ICA process along with other DOD management efforts has at least maintained track of cost increases if not controlled costs themselves. Maybe the most important benefit has been the visibility given different cost views at the top

level, thereby resulting in discussion of issues at the highest policy level (63:40). Using the ICA estimate as the program budget estimate may ease the adversary relationship between program manager and functional staff or may more effectively use limited cost estimating resources, but it will not appreciably enhance cost control.

The Chief of Staff of the Air Force recently formed an ad hoc Program Cost Task Force to determine how cost estimating can be improved, and to develop initiatives to control costs. But so long as cost estimates, by whatever means developed, are seen as fixed price contracts with Congress, so long as there is a long interval between original estimate and the final buy, and so long as estimates are depressed by the advocacy process as they wind themselves up to the DSARC, major advances in cost control will come sparingly.

## APPENDIX A

### Cost Growth Data

Last year I reported the annual cost growth of all Selected Acquisition Report programs, adjusted for escalation and quantity, dropped from 6.4% in December 1972 to 4% in 1975. This has been further improved to 3%. These results are often masked by inflation. But the progress is real and steady.

- Dr. Malcolm R. Currie (59:I-9)

The amount of actual cost growth is often difficult to determine. Once determined, it is often hard to attribute to courses other than poor management. In the above quote, the cost growth in 1976 was given as 3% adjusted for escalation and quantity. Including these two categories, the cost growth was closer to 6% or \$14.4B for the total acquisition of the systems. It is this dollar figure which causes Congress and the public to react strongly to DOD management.

### Selected Acquisition Reports

In order to provide some visibility for itself, DOD initiated quarterly reporting on selected, major weapon systems in the late 1960's. Subsequently, Congress asked for this information. Currently, 53 systems are reporting detailed cost data in Selected Acquisition Reports (SARs).

SARs summarize current estimates of technical, schedule, quantity and cost information in comparison with planning or development estimates (43:2). Planning estimates are estimates of operational/technical characteristics, schedule and complete acquisition cost developed at the time the Secretary of Defense approved program initiation. Development estimates are estimates

of these same parameters developed at the time the Secretary of Defense approved full-scale engineering development. Changes in the cost estimates are attributed by the program office under the following cost variance categories (43:11):

QUANTITY - a change in quantity to be procured other than changes in support items.

ENGINEERING - an alteration in the physical or functional characteristics of a system or item.

SUPPORT - a change in support item requirements.

SCHEDULE - a change in procurement or delivery schedule, completion date or intermediate milestone of development or production.

ECONOMIC - a change due solely to operation of the economy. This includes changes in the current estimate resulting from actual escalation different from that previously assumed and revision of the assumption regarding future escalation.

ESTIMATING - a change in program cost due to a correction of error in preparing the planning/development estimate or the refinement of a prior current estimate for reasons not provided for in other cost variance categories.

SUNDRY - changes other than the above categories, such as environment costs (34:2), sometimes called unpredictable change (43:12).

In the early 1970s, there was no consistent treatment of inflation. Since the Office of Management and Budget (OMB) viewed budgeting for inflation as a self-fulfilling prophecy,

some programs did not include it at all while others incorporated it under the "estimating" category. Criticism over cost growth eventually led DOD in 1971 to obtain a waiver to the OMB policy and to formally budget for and report cost variance due to inflation. When double-digit inflation became the rule, DOD published authorized maximum inflation rates which could be used by programs and incorporated inflation into the "economic" category. For this reason, SAR data from the early 1970s cannot be directly compared with that after 1974, and care must be taken in interpreting the percent cost growth attributed to estimating prior to 1974.

#### Some Cost Data

The following cost data was taken from the SARs as summarized by the United States General Accounting Office in its now annual report to Congress on the status of major acquisitions. It is somewhat comforting to know that non-military programs suffer the same, if not greater, cost growth (33:2, 34:3). Of 547 major civilian programs, 399 had experienced overruns as of 30 June 1976; of these, 148 had experience cost increases in excess of 100 percent (34:3ff).

TABLE A-1

Cost Growth During Specific Years

	<u>FY70</u>	<u>FY74</u>	<u>FY 75</u>	<u>FY76</u>
Engineering	20%	8%	6%	2%
Support	7	1	7	3
Schedule	15	7	32	20
Economic	10	79	11	23
Estimating	40	1	11	30
Quantity		-1	29	23
Sundry	8	5	4	0
Total Growth	N/A	\$24.1B	\$11.3B	\$14.3B

References 19, 24, 28, 31, 33, 34

TABLE A-2

Cost Growth from System Inception (as of 30 June 1976)

	Air Force	Army	Navy	Total
No. of systems reported	11	16	26	53
Planning/Development estimate*	\$36.3B	\$19.6B	\$65.1B	\$121.2B
Current Estimate	\$58.4B	\$28.2B	\$95.1B	\$181.9B
Total cost growth	\$22.1B	\$8.6B	\$29.9B	\$60.7B
Percent growth	61%	44%	46%	50%
Cost Variance**				
Engineering	13%	-4%	6%	7%
Support	-1	3	5	3
Schedule	23	15	16	18
Economic	52	70	36	47
Estimating	1	13	13	9
Quantity	4	1	19	11
Sundry	9	2	5	6

\*The development estimate is used unless only a planning estimate is available.

\*\*Percent of total cost growth

References: 34:3, 34:93-95

PROGRAM COST DATA APPEARING ON SELECTED ACQUISITION REPORTS  
AT JUNE 30, 1976  
(DOLLARS IN MILLIONS)

AGENCY AND PROGRAM	PLANNING AND/OR DEVELOPMENT ESTIMATE	COST CHANGE DUE TO					CURRENT ESTIMATE	
		QUANTITY	ENGI-NEERING	SUPPORT	SCHEDULE	ECONOMIC		
					ESTI-MATING	SUNDRY		
DEPARTMENT OF THE AIR FORCE:								
A-10 AIRCRAFT	2,489.7	117.5	95.0	789.3	748.3	63.8-	28.8	4,204.8
ADVANCED AIRBORNE COMMAND POST (E-4)	484.3	18.2	11.2-	101.7	42.3	120.9		695.1
AIRBORNE EARLY WARNING AND CONTROL SYSTEM (E-3B)	2,661.6	172.3-	40.1-	898.9	263.1	42.6-	8.9-	3,559.7
B-1 AIRCRAFT	11,218.8	27.9-	1,439.5	290.5-	1,964.3	480.2	143.4	21,619.0
*EF-111A AIRCRAFT	631.9	.5				40.1-		592.3
F-15 AIRCRAFT	7,355.2	109.5	68.0-	918.7	2,442.2	709.5	704.0	12,171.1
*F-16 AIRCRAFT	6,054.5							6,054.5
HAUVICK MISSILE (AGM-65A/B)	383.4	4.9	17.6	14.5	129.6	42.7-	35.1	595.6
MINUTEMAN III MISSILE	4,673.8	661.6	1,187.6	45.7-	177.3	1,008.1-	1,181.4	7,778.2
SIDEWINDER AIR-TO-AIR MISSILE	133.7	60.4	15.0	22.7	38.9	113.2		392.7
SPARROW III F MISSILE	254.1	309.2	15.1	160.9	96.6	26.2-	1.7	811.4
TOTAL (11)	36,341.0	823.1	2,892.7	319.0-	5,048.3	200.3	2,085.5	58,474.4
DEPARTMENT OF THE ARMY:								
AH HELICOPTER	1,800.2	288.8	140.1	42.5	312.2	828.6	46.5	3,458.9
AN/TCC-39 COMMUNICATIONS SWITCH (TMI-TAC)	801.1				226.6	1.6-		1,026.1
*CANNON LAUNCHED GUIDED PROJECTILE (COMPHEAD)	1,240.7		10.0	11.0-	20.4-			1,219.3
DRAGON MISSILE	404.2	208.2	24.8	7.8	60.3	142.3	38.1	885.7
*HILLBILT MISSILE	735.1							735.1
IMPROVED HAWK MISSILE	588.2	73.0	79.0	68.5	82.5	153.0	1.1	1,048.7

\*PROGRAM ADDED SINCE JUNE 30, 1975

TABLE A-3

PROGRAM COST DATA APPEARING ON SELECTED ACQUISITION REPORTS  
AT JUNE 30, 1976  
(DOLLARS IN MILLIONS)

TABLE A-3 Continued

AGENCY AND PROGRAM	PLANNING AND/OR DEVELOPMENT ESTIMATE	COST CHANGE DUE TO					ESTIMATING	SUNDRY	CURRENT ESTIMATE
		QUANTITY	ENGIN-NEERING	SUPPORT	SCHEDULE	ECONOMIC			
DEPARTMENT OF THE ARMY: (CONT.)									
LANCE MISSILE	652.9	226.4	14.1	18.5	79.2	8.3	5.0		1,004.4
MECHANIZED INFANTRY COMBAT VEHICLE	245.4	297.0	19.5	17.8	11.5	112.9	44.8	13.5	763.0
PATRIOT MISSILE (SAM-D)	5,240.5	1,082.4	869.5	178.4	597.1	1,000.8	861.3	27.6	5,953.8
ROLAND MISSILE	1,119.5	58.3	28.0	52.7	16.7		8.4	53.3	1,186.9
STINGER MISSILE	473.8	138.6	62.3	6.8	35.0	157.5	47.2	7.3	928.5
TACTICAL FIPE DIMENSION SYSTEM	160.5	39.7	46.2	34.9	18.9	55.0	110.5	11.6	454.1
TOW MISSILE	727.3	45.8	126.9	30.9	13.1	180.1	27.7	2.8	1,063.0
UTAS HELICOPTER	2,307.3	22.0	25.1	127.6	58.2	1,241.0	78.7	11.7	3,364.8
AM-1 TANK	3,005.4					1,911.6	2.6	4.3	4,918.7
*AM-178 HOWITZER	121.9	40.2	.2	5.8	4.3	47.5	26.5	1.1	247.5
TOTAL (16)	19,624.0	104.0	353.5	294.3	1,314.0	6,028.1	1,090.0	157.6	28,258.5
DEPARTMENT OF THE NAVY:									
A-7E AIRCRAFT	1,465.6	531.8	251.1	4.5	280.2	401.1	246.8		3,172.1
AEGIS MISSILE (MOT & E ONLY)	427.6		70.4	13.0	52.9	23.9			587.8
*CAPTOR ANTI SUBMARINE WEAPONS SYSTEM	329.2	7.1	8.8	51.4	22.0	165.2	230.0		799.5
CUN-38 FRIGATE	820.4	300.7	12.3			66.1	52.2		1,251.7
CM-53E HELICOPTER	578.4		52.1	74.4	15.8	66.1	36.2		750.6
CUNCOM MISSILE	441.0	75.8	43.7	27.9	96.9	36.7	11.9	31.8	590.3
CVN-68 CLASS AIRCRAFT CARRIER (PROCUREMENT ONLY)	4,010.2							643.0	4,653.2
DD-963 DESTROYER	2,581.2		35.0	18.0	2.0	653.9	80.2	444.5	3,810.8

\*PROGRAM ANNEED SINCE JUNE 30, 1975

PROGRAM COST DATA APPEARING ON SELECTED ACQUISITION REPORTS  
AT JUNE 30, 1976  
(DOLLARS IN MILLIONS)

AGENCY AND PROGRAM	PLANNING AND/OR DEVELOPMENT ESTIMATE	COST CHANGE DUE TO						ESTIMATING	SUNDRY	CURRENT ESTIMATE
		QUANTITY	ENGIN-NEERING	SUPPORT	SCHEDULE	ECONOMIC				
DEPARTMENT OF THE NAVY (CONT.)										
E-2C (HAWKEYE) AIRCRAFT	586.2	719.3	.92.3	263.0	51.4	46.4	142.1	2.1-	1,898.6	
F-14 (TOMCAT) AIRCRAFT	6,166.0	309.1	2.2-	702.9	617.3	230.7	573.2	79.1	8,676.1	
*F-1H AIRCRAFT	12,831.1							.1-	12,831.0	
FFG-7 SHIP	3,244.5	584.7	499.1	126.2	852.6	2,053.6	1,654.1		9,014.8	
HAWPOON MISSILE	1,031.8	16.6-	104.2	37.5	7.6	259.6	2.4-		1,421.7	
*LAMPS MK III	2,538.5								2,538.5	
LHA SHIP	1,380.3	436.9-	43.8	20.2	39.4	73.3	10.5	144.9	1,275.5	
MK-48 TORPEDO	1,753.8	306.8-	9.4	70.9-	249.3	133.5	216.0		1,984.3	
P-7C (ORION) AIRCRAFT	1,294.2	1,358.5	214.9	94.1-	368.7	254.4	136.9	6.1	3,539.6	
PHALANX CIWS	564.5	35.3-	115.9	93.5	134.1	52.3	4.4	.5	933.9	
PHM SHIP	726.2	533.1-	10.7	4.9	133.2	12.0	24.5	29.4	407.8	
PHOENIX MISSILE	536.4	44.3	69.0	16.6	407.7	239.0	2.2	57.5	1,372.7	
S-3A (VIKING) AIRCRAFT	2,891.1	70.9-		14.3	78.7	446.9	72.9		3,433.0	
SIDEWINDER AIM-9L MISSILE	99.7	60.1	27.1	8.7	35.4	18.1	44.6	1.5-	292.2	
SPARROW III-7F MISSILE	453.6	152.4-	54.0	32.8	125.2	292.7	9.3	35.9	851.1	
SSN-598 SUBMARINE	5,747.5	1,945.5	90.1	19.7		1,836.5	51.5		9,690.8	
*SURTASS ARRAY SENSOR	259.3		54.9	6.1	17.1	31.3	119.3	4.6	492.6	
TRIDENT SUB/MISSILE SYSTEM	12,431.1	1,344.8	8.0	52.9	1,169.6	3,419.0	358.6	65.0	18,849.0	
TOTAL (26)	65,193.4	5,563.9	1,864.6	1,414.5	4,753.1	10,812.3	3,978.8	1,538.6	95,119.2	

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#### Interviews

All interviews were conducted on a non-attribution basis. Therefore, the individuals are not quoted or referenced in the text. However, the material gathered in interviews provided the basis necessary to examine the issues and draw conclusions from referenced sources.

Arena, J.A., Major, USAF. Cost Analyst, Office of the Assistant Secretary of Defense for Program Analysis and Evaluation. Formerly a Budget Analyst at Headquarters United States Air Force.

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