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PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

UNDERSTANDING CONTRACTOR MOTIVATION
AND CONTRACT INCENTIVES

Study Project Report
PMC 77-1

Phillip E. Oppedahl
Commander USN

FORT BELVOIR, VIRGINIA 22060

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UNDERSTANDING CONTRACTOR MOTIVATION
AND CONTRACT INCENTIVES

Study Project Report
Individual Study Program

Defense Systems Management College
Program Management Course
Class 77-1

by

Phillip E. Oppedahl
Commander USN

May 1977

Study Project Advisor
Dr. Joseph L. Hood

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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STUDY TITLE: UNDERSTANDING CONTRACTOR MOTIVATION AND CONTRACT INCENTIVES

STUDY PROJECT GOALS:

- To understand the theory and the objectives of Department of Defense contract incentives.
- To review a sample of active contracts and compare with theory.
- To understand the defense contractor motivational environment.
- To understand the interface relationships which operate between the Department of Defense and the defense contractor.

STUDY REPORT ABSTRACT:

This study examined the theory of incentive contracting as conducted by the Department of Defense. The author also studied the motives and motivational environment of the defense contractor. A comparison analysis reveals that the contractor drive (motive) is not always commensurate with the incentive target. A hierarchy of needs for contractor firms is proposed as an aid to understanding the contractor's motivational environment. A "shared leadership" model is offered as an improvement step toward better government-contractor interface relations.

SUBJECT DESCRIPTORS: INCENTIVE CONTRACTS, CONTRACT MANAGEMENT, CONTRACTOR MOTIVATION, MOTIVATION, AND MATERIAL ACQUISITION

NAME, RANK, SERVICE	CLASS	DATE
Phillip E. Coppdahl, CDR, USN	PMC 77-1	MAY 1977

EXECUTIVE SUMMARY

The Department of Defense must procure the weapon systems which provide the means for our military services to carry out national policy. These weapon systems are designed and built by defense contractors. The document which links the government and the contractor is the formal contract.

The purpose of this study is to focus on the interface relationship between the government and the contractor. On the government side, an overview of the theory of contract incentives is explored. From the contractor's side, an insight into the motivational factors which drive the contractor is gained. The two viewpoints are compared and found to be divergent at times. The government structures contractual incentives on the profit motive. The contractor, when placed on the hierarchy of needs (motives), may be operating with other motives as predominant for an individual contract. Incentives structured on the wrong motive are doomed to failure. Finally, the managerial relationship between the government and the contractor is analyzed and found to be restricted by regulation and opinion. A "shared leadership" model is proposed for adoption as an improvement to the "military-industrial complex" relationship.

ACKNOWLEDGMENTS

For his counsel and guidance as a Study Project Advisor, I wish to express my sincere appreciation to Dr. Joseph L. Hood. I also appreciate the outstanding assistance provided by the Defense Systems Management College library staff; their willingness to help is exceptional. To my wife, Sharie, I express a special thank you for her continued support and understanding.

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SECTION I
INTRODUCTION

The purpose of this study project is threefold. The first purpose is to become familiar with the Department of Defense (DoD) policy on the use of incentives in contracts. Secondly, to ascertain the current attitude on incentives by reviewing active contracts and interviewing contract officers. Third, the last purpose is to glean knowledge from the literature concerning the motives or drives of defense contractors. The complexity of the problem is recognized at the outset and the potential lack of a complete understanding is accepted.

Historically, the mechanism used to encourage results from defense contractors has taken the form of profit incentives, i.e., profit is increased or decreased in return for contractual performance on the part of the contractor. Various approaches have been attempted; each approach has met with success in some cases and failure in others. By their very nature, incentives recognize that a contractor has motives and reacts to a motivational environment. The comparison of the theory of DoD contract incentives to the observed motives of the defense contractors will meld the problem and hopefully bring the solution into focus.

Because the magnitude of this problem is beyond the scope of this study, some limits will be set. First, incentives will be defined as only the apparent contract incentives, i.e., cost, schedule and technical performance incentives. Other less obvious incentives such as are contained in the weighted guidelines will not be addressed. Secondly, a limited sample of active contracts will be reviewed. An attempt will be made to pick the most representative type contracts. Third, the insight

into contractor motivation will come entirely from the literature; time is not available to conduct a questionnaire based data collection study.

SECTION II

Incentive Theory

This section will address the theory behind incentives as utilized in DoD contracts. The viewpoint will be limited to that of the government as expressed by regulations and guidelines. Other viewpoints and considerations will be addressed in later sections. See Incentive Contracting: A Synopsis and Guide (1:1-72)* for a more detailed treatment of this subject.

The Department of Defense and the National Aeronautics and Space Administration Incentive Contracting Guide makes the following statement: (2:vii)

Simply stated, the objective of any incentive contract is to motivate the contractor to earn more compensation by achieving better performance and controlling cost.

In the normal free enterprise market, it should not be necessary to use this special type of motivation to compensate the contractor to achieve better performance and to control costs. Supply and demand forces should be sufficient to provide the balance required. Since this is not the case, we therefore must recognize that a special consideration is present in the DoD weapons acquisition market.

The hardware purchased by the Department of Defense (DoD) is unique and in general has very little relation to use outside of the DoD. Consequently, the defense contractor has only one buyer for his product. Further complicating the supply and demand equation is the fact that many weapons systems can be produced by only a few specialized contractors.

Contract incentives can be viewed as a means to help create part of the motivation of a true free enterprise system. To be meaningful, an

*This notation will be used throughout the report for sources of quotations and major references. The first number is the source listed in the bibliography. The second number is the page in the reference.

incentive must be capable of inducing some specific effort on the part of the contractor that he would not have otherwise accomplished. The DoD and NASA Incentive Contracting Guide (2:viii) takes this a step further and states:

The incentive contract should communicate the Government's objectives to the contractor and motivate the contractor's management to convey the Government objectives within the contractor's organization.

We must, therefore, recognize that the contractor is comprised of people and we are really motivating people and not simply an organization.

Wright Brothers Incentive Contract

Until the last 25 years, we have little historical evidence of the use of contract incentives. One of the earliest indications is procurement of a Heavier-Than-Air flying machine from the Wright Brothers in 1907 (3:3). This contract for a base price of \$25,000 contained a performance incentive on airspeed as follows:

40 miles per hour,	100 percent
39 miles per hour,	90 percent
38 miles per hour,	80 percent
37 miles per hour,	70 percent
36 miles per hour,	60 percent
Less than 36 miles per hour	rejected.
41 miles per hour,	110 percent
42 miles per hour,	120 percent
43 miles per hour,	130 percent
44 miles per hour,	140 percent

The Wright Brothers were able to provide the airplane with a speed of 42.5 miles resulting in a bonus of \$6,250. Incentive type contracts have been utilized in increasing numbers since the early 1950's. Today most of the large weapons procurements contain some form of incentives for cost, schedule or technical performance.

Contracts utilized during the weapons acquisition process are basically

of two types, Fixed-price or Cost-reimbursement. The primary variable is responsibility for monetary risk, the capability to make or lose money on a contract. With the pure fixed-price type of contract, the contractor accepts nearly 100% of the risk while with the pure cost-reimbursement contract, he accepts almost none of the risk. The variations between these two extremes contain the various incentive type contracts which in turn can be associated with more or less responsibility for monetary risk.

Incentive Contract Guidelines

The formal descriptions of the various type contracts can be found in Section III of the Armed Services Procurement Regulation. The general guidelines referenced for use in an incentive environment are listed here as found in the DoD and NASA Incentive Contracting Guide (2:4-5).

Cost-Plus-Fixed-Fee. (CPFF) Appropriate where "level of effort" is required or where high technical and cost uncertainty exists.

Cost-Plus-Award-Fee. (CPAF) Appropriate where conditions for use of a CPFF are present but where improved performance is also desired and where performance cannot be measured objectively.

Cost-Plus-Incentive-Fee. (CPIF) (Cost Incentive Only). Appropriate where a given level of performance is desired and confidence in achieving that performance level is reasonably good but where technical and cost uncertainty is excessive for use of a fixed-price incentive.

Cost-Plus-Incentive-Fee. (CPIF) (Multiple Incentives). Appropriate where expectation of achieving an acceptable performance is good but improvement over that level is desired and where technical and cost uncertainties are excessive for use of FPI.

Fixed-Price-Incentive. (FPI) (Cost Incentive Only). Appropriate where confidence in achieving performance is high but cost and technical uncertainty can be reasonably identified.

Fixed-Price-Incentive. (FPI) (Multiple Incentives). Appropriate where improved performance is desired and technical and cost uncertainties reasonably identifiable.

Firm-Fixed-Price. (FFP) Appropriate where performance has already been demonstrated and technical and cost uncertainty is low.

Firm-Fixed-Price. (FFP) (With Incentives Added). Appropriate where improved performance or schedule is desired and technical and cost uncertainty is low.

As stated previously, the pure fixed-price contract (FFP) contains the most risk for the contractor and on the other hand can be the most profitable for him. It therefore is the ultimate for profit incentive and should in fact be utilized whenever possible.

While the FFP contract is used extensively for final production contracts, the DoD must use other types when in earlier phases of the acquisition process. The contractor is not willing to accept all the risk on a Research and Development contract. The pure cost-reimbursement (CPFF) contract contains minimum risk for the contractor along with no capability to increase profit. The government has the risk responsibility, however, the drawback is the fact that the contractor has little motivation to reduce costs. Between these two extremes lies the incentive type contracts which attempt to carry out the emphasis desired by the government for that particular contract.

The incentives are generally tied to an increase or decrease in profit or fee for the contractor. This is accomplished through the use of a sharing formula which is generally expressed as a percentage ratio. For example, if an 80/20 share ratio was negotiated, the government would pay 80% of the cost overruns and realize 80% of the savings in underruns. The contractor would likewise lose fee at the rate of 20% on an overrun and increase fee at 20% of an underrun. Similar share ratios can be associated with schedule and performance objectives. When objectives cannot be easily measured, the subjective award fee is utilized to

increase fee but not as a penalty to reduce fee.

Summary

In summary, incentives in contracts between the DoD and industry are utilized for various reasons. First, the weapons acquisition process is not accomplished in a true free enterprise environment. Secondly, incentive contracts allow the DoD and the contractor to share the risk of development programs. Third, the incentive features of the contract are used to communicate the DoD's objectives to the contractor. Lastly, the contractor is encouraged to make tradeoffs between cost, performance and schedule with a reward of increased profit or fee.

SECTION III

Current Incentive Contracts

In this section, the current state of incentive contracting will be addressed. Three contracts were selected for review. They will be identified as A, B and C. A and B are for full-scale development contracts and C is a production contract.

All three contracts have a price in excess of 200 million dollars, two are cost plus incentive fee (CPIF) contracts and the third is fixed price incentive (FPI) contract. The CPIF contracts also have an award fee consideration included. Conversation with contracting officers indicates that these are representative of current incentive contracts. It is recognized that they form a small data base, however they will fulfill the purpose of examples while remaining within the scope of this project.

Example A

Example A is a cost plus incentive fee (CPIF) contract with provisions for an increase/decrease in fee for attainment of a design-to-cost (DTC) goal and for an award fee for attainment of certain performance objectives.

The basic incentive is based on contract cost. A 70/30 share line is established above and below the target cost. The contractor earns an increase in fee of 30% of all savings in costs below the negotiated target cost of the contract. Likewise he shares in the overrun costs by a reduction in fee equal to 30% of the costs in excess of the target cost. The increase or decrease of fee based on this incentive is limited within the range of zero dollars to a maximum of 38 million dollars.

The design-to-cost (DTC) incentive is based on the projected numbers of systems which will be purchased under production contracts. A

cumulative DTC objective is established based on the recurring costs associated with production. Recurring costs include engineering direct labor, manufacturing, direct labor, direct material, applicable overheads, maintenance of tooling and test equipment, warranty, independent research and development, general administrative expense and profit. Costs not included in the DTC goal are facilities, tooling, test equipment, design and development testing, integrated logistic support, production engineering support and shipping containers. The DTC objective is modified for quantity and delivery variance and for abnormal fluctuations in the economy. The quantity and delivery variance clause is quite complicated and consumes twelve pages in the contract; its purpose is to adjust the goal in an equitable manner in the event of future changes in quantity ordered or delivery rate. The objective is also modified either up or down based on the variance of actual labor or material indices with predicted growth rates. An 85/15 share line determines the increase or decrease of fee due to underrun or overrun of the design-to-cost objective. No limits are established for this increment of the fee other than the contract limits of zero to 38 million dollars.

The award fee is determined primarily on subjective terms and unilaterally by the government. It has a range of zero to 8 million dollars. It is divided into three periods of time and is based on reliability and maintainability factors. The major part of the total award (5.5 million) will be paid to the contractor for a substantial increase in mean time between failure (MTBF) above an established goal. The amount of award determined by the increase in MTBF is then adjusted subjectively based on the decisions of the Performance Evaluation Board. The board will consider the following items in determining award:

1. Effective reliability and maintainability plan.
2. Utilization of mission profile data.
3. Establishment of reliability prediction data.
4. Application of stress and worst case analyses.
5. Utilization of effective derating criteria.
6. Application of failure modes, effects and criticality analyses.
7. Utilization of design reviews to assure meeting specification requirements.
8. Application of subcontractor and supplier controls.
9. Implementation of an orderly test, analyze and fix system.
10. Maintainability Index.
11. Mean time to repair less than goal.
12. Maintenance man hours per operating hour.
13. Replacement parts cost per operating hour.
14. Maximum repair time goal for organizational and intermediate levels of maintenance.

The target fee negotiated for this contract was 26.5 million dollars. As noted earlier, the range of fee that can be paid on this contract is from zero to 38 million dollars. Therefore, the three distinct fee pools can vary widely as long as the total remains within the contract fee range. The only fee pool with a dollar restraint is the award fee (0-8 million). The contractor can, therefore, make trade offs between dollars used for contract cost, DTC cumulative costs and reliability and maintainability (R&M) performance. These trade offs can be expressed mathematically as implied values, that is, a prescribed amount of R&M capability is equal to an increase in contract cost. These relationships are depicted in Figures III-1 and III-2 with isofee lines plotted to illustrate the trade off potential. For example, on Figure III-1, note that the contractor can exactly meet the contract cost (100% cost) and also exactly meet the Design-to-Cost goal (100% DTC) and the resulting fee is equal to 26.5 million dollars. However, the contractor may elect to accept an overrun of 10% (110% cost) and balance the corresponding loss of fee with an increased fee from a reduction in the DTC goal. As shown on Figure III-1, a 10% cost overrun is equal to a 7% (93% DTC) reduction in the Design-to-

EXAMPLE A

FEE VALUE TABLE

1	=	0.00
2	=	10.00
3	=	20.00
4	=	30.00
5	=	40.00
6	=	50.00

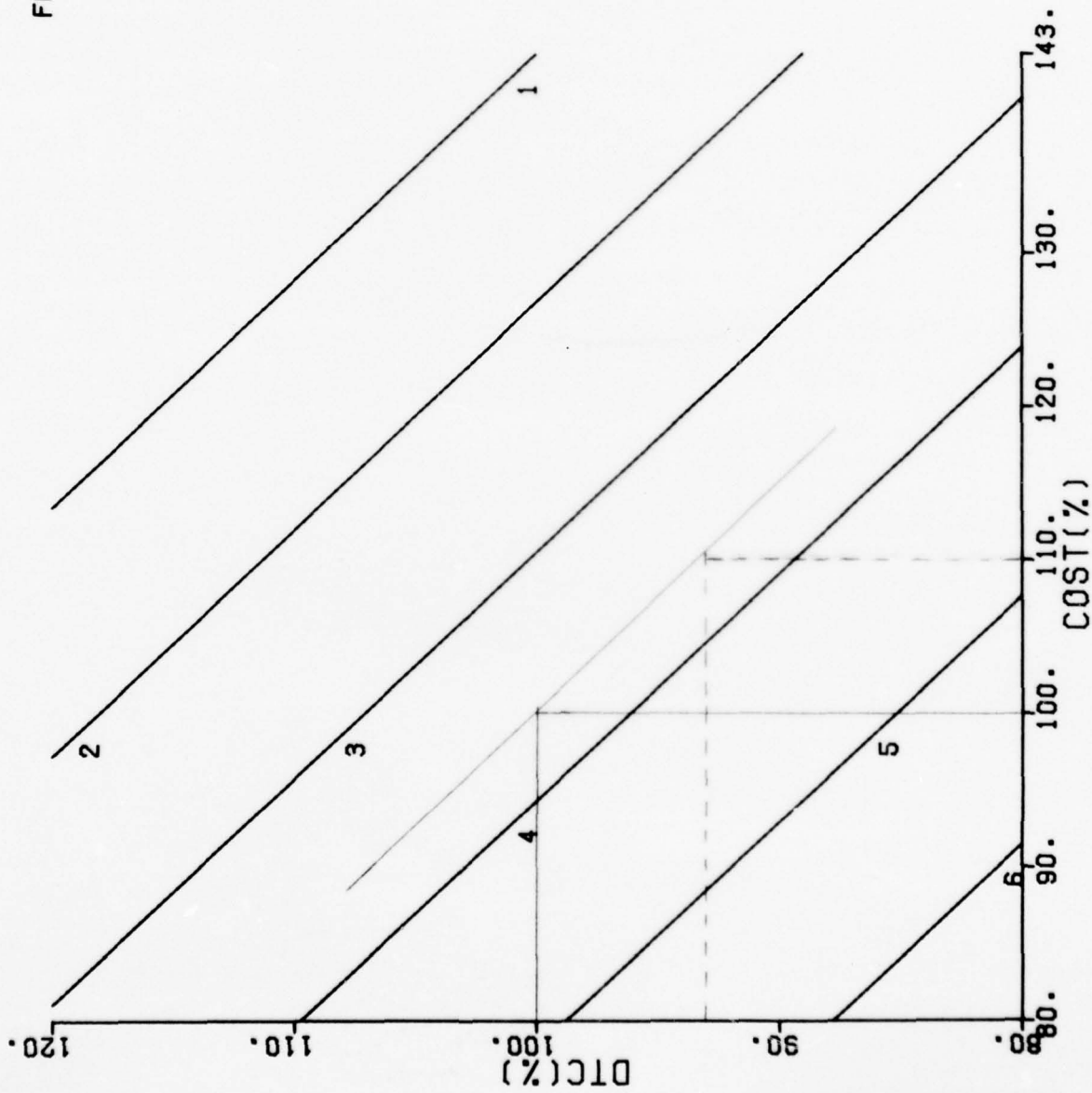


Figure III-1

EXAMPLE A

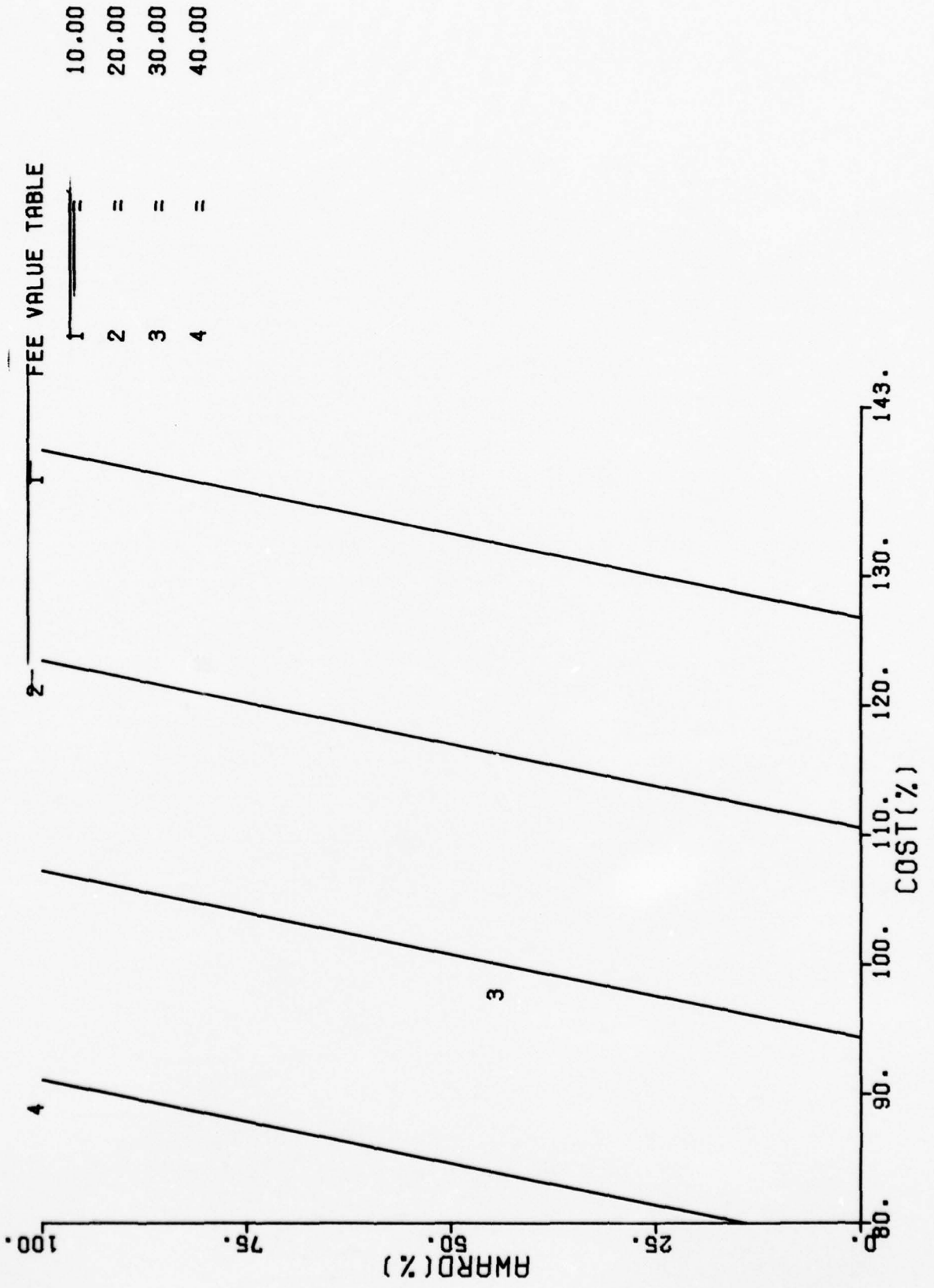


Figure III-2
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Cost total. The contractor will still realize a fee of 26.5 million dollars. On Figure III-2, similar trade offs can be made between the contract cost fee pool and the award fee pool. The award fee cannot be negative; it therefore is plotted from zero to 100%. The DTC incentive fee will not be determined until the planned first increment production completion; therefore, the fee paid under the terms of this contract will not be finalized for at least six years following the effective date of the contract.

Example B

Example B is also a cost plus incentive fee contract with an award fee. It is a development contract and contains the same three fee pools as the previous example. The share ratio for contract cost is 80/20 and for the DTC objective is 85/15.

The award fee pool contains 39 million dollars and is available for award in three areas divided as follows:

- | | |
|---|------------|
| 1. Life Cycle Cost and program management | 15 Million |
| 2. Reliability | 12 Million |
| 3. Maintainability | 12 Million |

Program management is judged on successful attainment of program milestones. Life cycle cost (LCC) evaluation factors are as follows:

1. The overall cost reduction to LCC resulting from the cumulative design efforts during FSD as compared to initial LCC projections.
2. The effective/efficient application of LCC projections and DTC/LCC trade off analyses with particular emphasis on those trade studies supporting proposed ECP's.
3. The achievement of reliability and maintainability during the design process to minimize LCC considering the development and unit production cost alternatives.
4. The Contractor's ability to define acceptable applications of Reliability Improvement Warranties, and correction of

deficiency programs to significantly reduce LCC.

5. The Contractor's control of pertinent LCC parameters resulting from subcontractor and supplier efforts.
6. The effectiveness of management and engineering efforts to resolve problem areas identified in the LCC program.
7. The degree of realism of the output data of the LCC analyses to correctly account for the impacts of LCC of the high cost elements.
8. The acceptability of the Contractor Logistics Support Analysis (LSA) Program and results.
9. The Contractor's success in achieving Personnel cost reductions which optimize personnel skill levels.

Reliability awards are based on achievements in increasing the mean time between failure. This evaluation is made after production systems have demonstrated the requisite criteria.

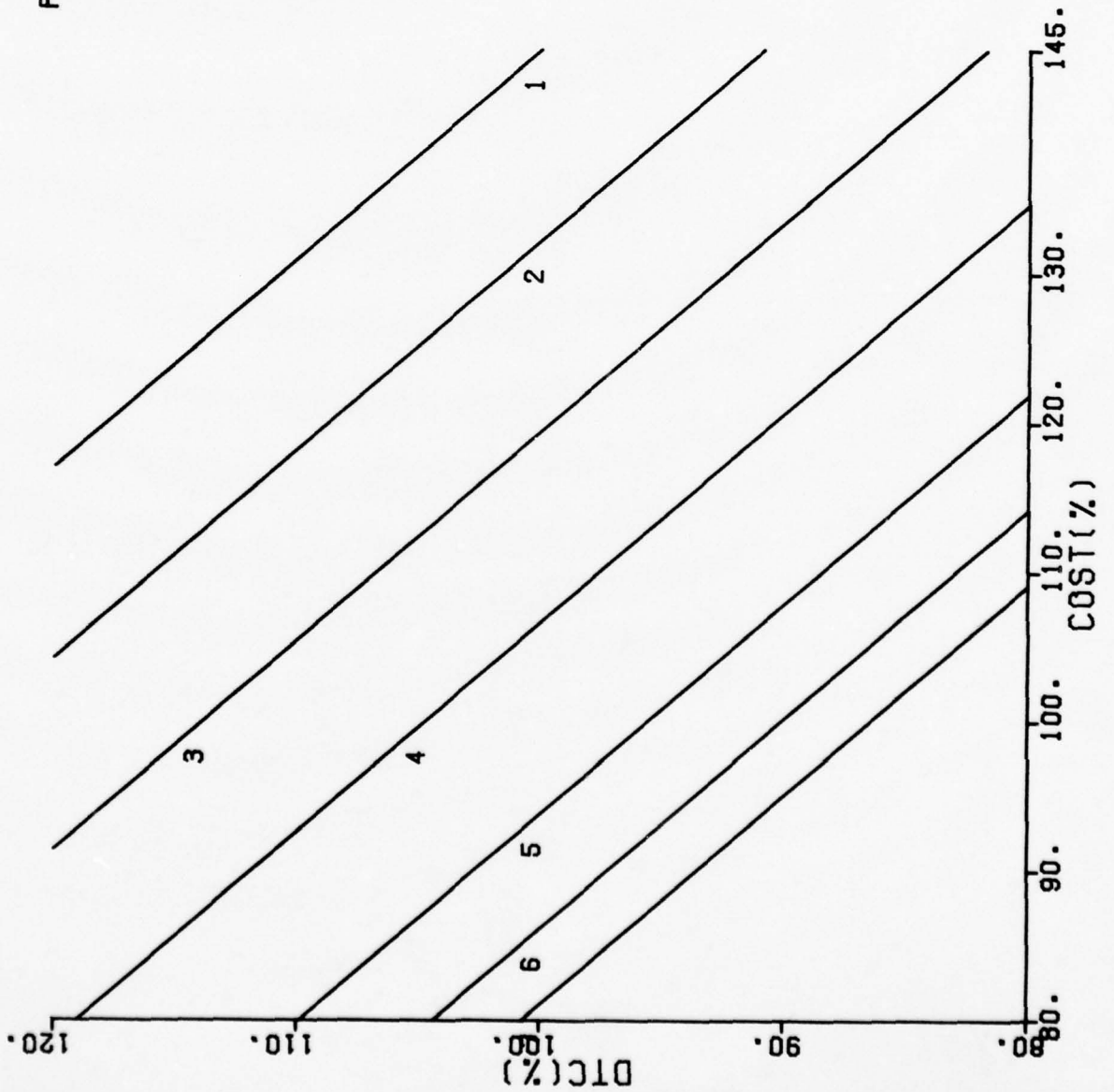
Maintainability award payments are based on the contractor's achievements in decreasing unscheduled maintenance man hours per operational hour and increasing the mean operating hours between maintenance actions. The terms of the award payments are detailed in a signed agreement between the contractor and the government consisting of 25 pages.

The target fee for this contract is 88 million dollars. The award fee is constrained between zero and 39 million dollars. The contract cost incentive fee and DTC incentive fee can vary over a wide range within the total fee limits of zero to 115 million dollars. Comparisons of contract cost to DTC and to award provisions are shown in Figures III-3 and III-4, respectively. Trade offs can be made within the total profit pool in the same manner as Figure III-1. An interesting aspect of this example is the fact that 31 million dollars are designated for subcontractor incentive awards.

EXAMPLE B

FEE VALUE TABLE

1	=	0.00
2	=	25.00
3	=	50.00
4	=	75.00
5	=	100.00
6	=	115.00
7	=	125.00



EXAMPLE B

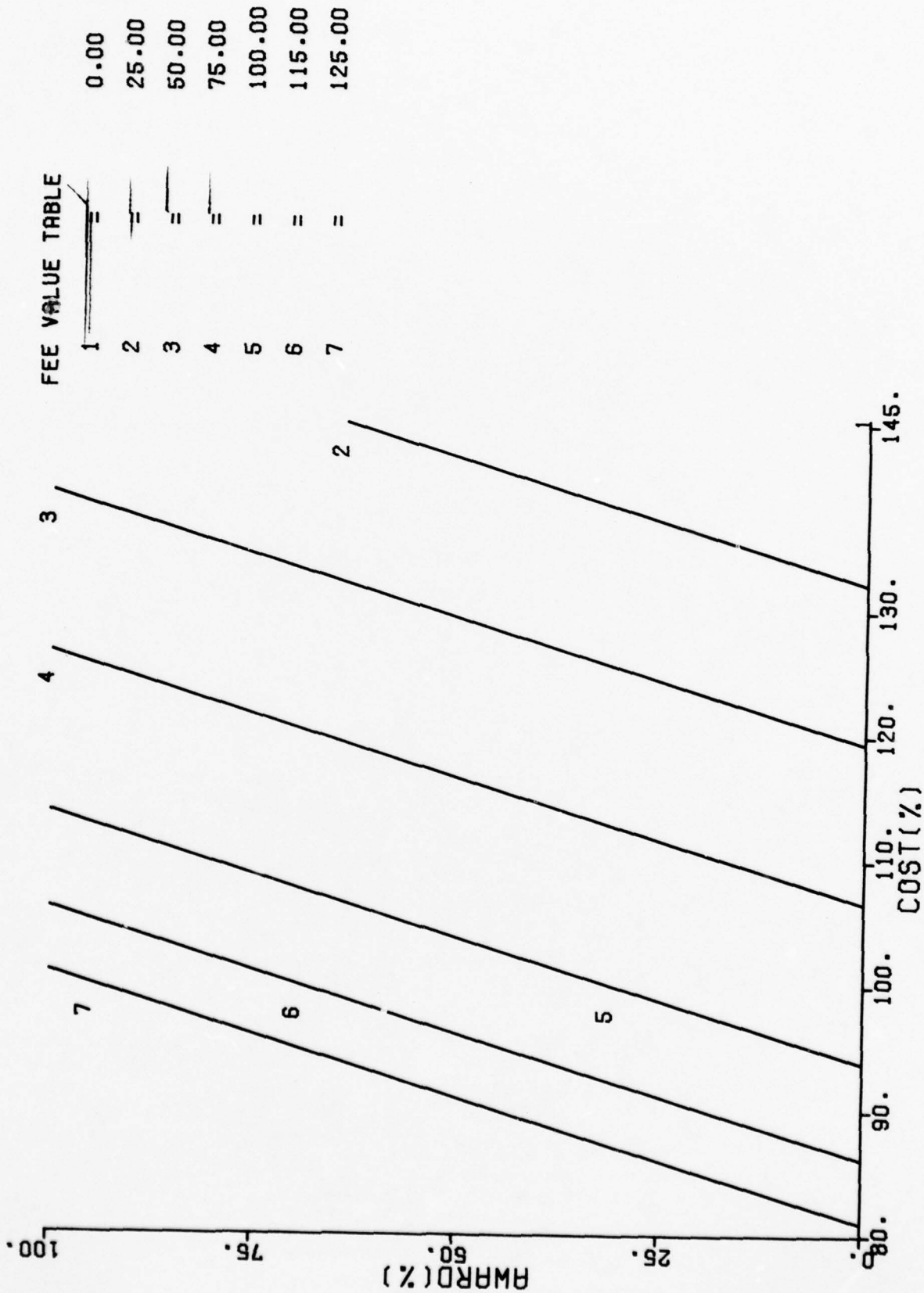


Figure III-4

Example C

This example is a production contract for an incremental buy of a weapons system. It is a fixed price incentive type contract with a target profit of 25 million dollars. The term profit is used on fixed-price contracts and is synonymous with the term fee for cost type contracts. The incentive feature is an 80/20 share ratio both above and below target cost. This operates exactly like the earlier CPIF share lines with one important difference. A firm ceiling price is specified, above which the contractor assumes total cost responsibility. The cost to the government cannot exceed the ceiling price (firm target); and, therefore, the contractor assumes total cost assumption at a point slightly less than the ceiling price. This is the point where contract price plus the corresponding profit share equal the ceiling price and is called the point of total assumption. See Figure III-5 for a graphical presentation of the variance of profit with a change in contract cost. The solid lines equate the contract cost (100% cost) to 25 million dollars fee. The dashed line shows that the point of total assumption is at 108% of contract cost.

This contract also has a value engineering clause included. Under this clause, the contractor is rewarded for submitting cost reduction proposals which effect the design or specifications of the product without impairing the essential functions and characteristics of the product. Once the value engineering proposal is accepted by the government, the contract price is reduced at the rate of 50% of the total cost reduction due to the proposed change. The remaining 50% allows the contractor to secure additional contract profit due to the 80/20 share ratio on contract cost. The contractor is also given a royalty share on future contracts for this product. In addition, the value engineering clause contains a collateral

EXAMPLE C

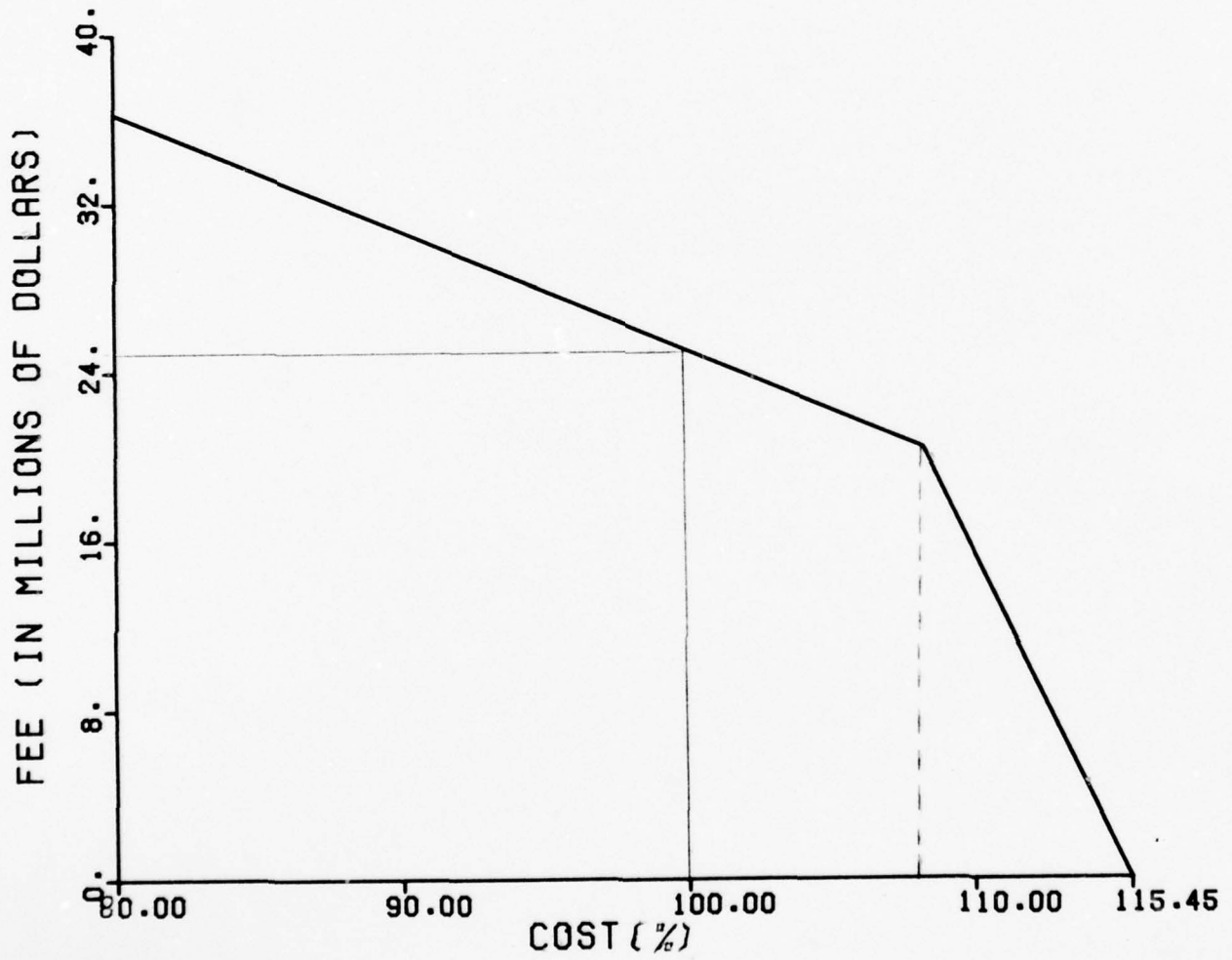


Figure III-5

savings estimated to accrue to the government during a typical year of use of the item in which the change is incorporated. Collateral savings would include reductions in cost in areas such as government-furnished property, operations or logistic support which exceeds any increase in acquisition cost.

The incentive function on this fixed price incentive contract is based on cost only. Performance and DTC objectives are not normally appropriate for a production contract.

Summary

From these examples, we note that the current emphasis is on the use of DTC objective incentives and award fees to incentivize the contractor's attention to life cycle costs, management techniques, reliability and maintainability. In the production phase, the emphasis is shifted to cost only with value engineering clauses to stimulate cost reducing changes. In the next section, the other side of the equation will be inspected, contractor motivation.

SECTION IV

Contractor Motivation

What factors motivate a corporation? How much motivation is required on an individual contract? What motivates the management of a corporation? How do the motives of the employees affect the outcome of individual contracts?

The answers to these questions are critical to the understanding of inter-organizational relationships. But how much do we know about the subject? Much has been written on motivation of people in the last thirty years. On the other hand, the literature has much less to offer on motivation of one organization by another organization.

The interest in motivation of people in recent times can be traced to the Hawthorne studies conducted in 1924 and the work of Mayo (4:2). In his "Rabble Hypothesis," he states "management operated and organized work on the basic assumption that workers, on the whole, were a contemptible lot." McGregor identifies this sort of management as Theory X and also develops the Anti-Theory X approach and calls it Theory Y (5:10). Herzberg identifies factors that influence people as either motivators (satisfying) or hygiene factors (dissatisfying) (6:ix). Hackman extends Herzberg's theories with a recipe for job enrichment, an application technique (7:57). The hierarchy of needs as established by Maslow is a widely accepted approach which identifies individual motives (8:4). Likert established the notion of management systems as a continuum consisting of four identifiable subsets, an extension of Theory X-Theory Y. Likert also introduced the linking pin theory within organizations (9:10). The motivation of people is a subject for another time; however, it is an

interesting subject and must be understood before one can begin to understand the motivation of organizations.

In the last ten years, several organizations and people have collected data relative to the motivation of contractors. Some of these studies known to the author will be listed with major conclusions.

AN ANALYSIS OF GOVERNMENT/CONTRACTOR INTERACTION AS A MOTIVATOR OF CONTRACTOR PERFORMANCE (10:1-90)

This analysis by two Air Force Captains, Runkle and Schmidt, contains a hypothesis which states that relationship exists between the formal structure of "influential government/contractor interaction" and documented "contractor performance ratings." The stated interaction is considered to be a function of the interaction of government/contractor top management positions and the frequency with which these positions formally interact. Their data was collected on 56 contracts over a period of eight years. It should be noted, however, that they used NASA contracts, not DoD. They also utilized Cost-Plus-Award-Fee contracts; they are the only contracts with formal interaction on a regular basis.

Their results were positive; that is, their hypothesis was supported on both counts. They conclude that communicating with the top management level in the performance evaluation process results in "better" performance (i.e., higher performance ratings). Moreover, by increasing the frequency with which these top-level managers interact, accomplishment of the government's contracting objectives further improves.

EFFECTIVENESS OF INCENTIVE CONTRACTS AS MOTIVATORS (11:1-61)

A thesis by two Navy Lieutenants, Hill and Shepard, this paper reports the results of a survey of corporate and DoD personnel. They

report that incentives from incentive contracts are not passed down to lower levels within the organization. Also, in the three companies questioned, there was not a conscientious program of trade offs designed to maximize profits. Nor were various types of contracts treated with different attention; all were treated in a similar manner administratively. One company president said:

With government contracts there is too much written reporting and not enough physical involvement....A FPI contract with a 75/25 or an 85/15 share ratio is not a very good incentive and if the contractor sees an underrun, he will spend to build himself up. Motivators include promotions, training programs, and incentive plans based on profit for top management.

When asked what motivates him a company project manager replied:

Of course pay and promotions are important, but the real driving force is the personal satisfaction that I have done a good job. Even if I bring a project in over target cost, but know that I have done as well as possible, I am still personally satisfied.

One of the problems expressed by the authors is that in many cases incentives are paid years following the actual act. Because of this time delay, incentives which require historical criteria are ineffective. They also point out that contractors feel that they receive too little attention in the early phase of the contract. The PMO appears to be uninterested in the contractor during the most crucial period of the contract.

FEDERAL PROCUREMENT: A STUDY OF SOME PERTINENT PROPERTIES, POLICIES AND PRACTICES OF A GROUP OF BUSINESS ORGANIZATIONS (12:245-299)

Hunt, Rubin and Perry conducted a survey of 27 industrial organizations under a NASA grant. The survey was designed to:

- a. illuminate selected perceptions, policies and procedures regarding government contracting;
- b. describe general business objectives and managerial methods; and
- c. yield assessments of how the surveyed firms perceived their present

and future business prospects.

Most of the 27 firms were heavily engaged in Research and Development (R&D) tasks, 19 were prime system contractors and the remainder worked chiefly as subcontractors. Twenty companies did over 80% of their business with the government, primarily with the DoD.

Concerning administration of contracts, they found that it was more the exception rather than the rule when a respondent stated flatly that they administered incentive contracts differently from other varieties. Two-thirds of the firms did not, in fact, adjust procedures to maximize incentive gain. Several firms did comment, however, to the effect that incentive-type contracts tended to get somewhat more managerial attention.

Hunt, *etal*, also report on the use of incentives between the prime contractor and subcontractors. Sixty percent of the firms replied that incentives were used frequently between contractors. The most frequent performance incentivized was delivery of product, however, it was normally accomplished in the form of a penalty or liquidated damages for late delivery. Subcontract incentive rationale was classified into three categories, in order of frequency:

1. To induce motivation with an express emphasis on performance quality and/or delivery (n=9).
2. To induce generalized motivation or operational discipline to insure that work receives the attention of management (n=5).
3. To distribute risk more equitably (n=3).

The authors' motives in questioning the firms concerning their use of incentives inter-firm were to tap their basic beliefs about the functions and utilities of incentive structures in contracts.

In answer to their question concerning the internal incentive schemes

of firms, the authors find that, by and large, internal incentive systems were confined to management levels, often only to executive levels. It appears that, to the extent contractual incentives are used to galvanize effort, they are oriented more toward schedule and performance than toward cost parameters. In other words, personnel are incentivized in opposition to cost control; they are not required to trade off schedule and performance against cost parameters.

Concerning profit targets, the study indicates that "large" defense contractors tended to look upon a going-out profit of 6-8% and downward as reasonable. Small contractors, on the other hand, looked for 6-8% and upward as a going-out profit. Firms with high absolute sales plainly were prepared to accept lower profit rates.

When asked to list contracting goals, the firms answered as follows, in order of importance:

1. Foster quality performance
2. Protect the contractors against risk
3. Safeguard proprietary interests
4. Offer operational flexibility
5. Stimulate high levels of contractor/government communications
6. Engender high degrees of motivation to control costs
7. Yield a high profit level
8. Reduce government technical direction of surveillance
9. Foster program discipline.

From this list, we see what firms feel are important to accomplish when negotiating individual contracts. Note the relative importance of controlling costs and yielding profit. Hunt, Rubin and Perry summarize as follows:

From a review of the conditions companies sought (or did not seek) to satisfy when contracting, we inferred that on the whole they could be characterized as risk-averse, intent on preserving their bargaining position relative to the government, and strongly oriented toward quality performance and the preservation

of working relations with the customer; they were not so pointedly concerned with costs nor with maximizing profits.

As reported by Cirone in the National Contract Management Journal (13:53-66), Hunt found that government people constantly stressed profit motivation as a reason for entry of corporations into the defense market. However, contractor personnel who wanted to satisfy their achievement needs by involvement in highly technical fields, saw the government market as the only market capable of satisfying their desires. Dr. Hunt comments on this situation by describing it as one in which "The company may be as much pushed as attracted to the government market." Cited as reasons for entering government markets (with the percentages of persons citing them) were:

1. The idea that the government market was the only market or the only sizable market for the product the organization wanted to sell. (26%)
2. That the government is, if not the only market, a large market affording high volume sales. (24%)
3. That the government market offers a chance to develop personnel (both managerial and technical) and/or potential commercial products. (22%)
4. Natural interest in involvement in technological fields. (20%)
5. That the government is a low risk market (implying either that it is safe or that it is a low investment market). (17%)
6. That it affords opportunities for profit. (14%)
7. Patriotic duty. (10%)
8. That it provides a chance for market diversity. (7%)
9. Glamour or opportunities for image building. (6%)

It is evident that sales of product and personnel development rank high as reasons for doing business with the government.

The data collected from 1283 individual questionnaires and 244 personal interviews indicate some important differences in perceptions as viewed by government and contractor personnel. Government people tend to de-emphasize the importance of intra-organization inter-personal relations. Coupling this with the government's emphasis on the "procurement process" and "possibilities for follow on work" as determinants of contract performance indicates the greater premium placed by the government people on rigid structuring devices to frame the contractor-sponsor relationship.

Contractor personnel, on the other hand, "more often stressed their own internal organizational properties (including...human relationships) and decisions made during the production process." The study pointedly indicates:

What is called for today is a shift of focus from the mechanics of contracting to the dynamics of planning, negotiating and administering. This shift involves a transfer of stress from the making of contracts to a more active concern with the process of performance control and evaluation, alternative methods of project management and felicitously integrating contract administration into program management enterprise.

Another area of major difference in perceptions between government and contractor personnel was the importance of profit. Government people ranked profit and profit centered goals consistently higher than contractor interviewees. Industrial people tended to rank growth (both sales and capability) much higher than perceived by government people. Dr. Hunt concludes that "monetary and profit goals are more central to the thinking of government people about business objectives, whereas growth (sales and/or capability) is more so among contractor informants."

AN EXAMINATION OF THE FOUNDATIONS OF INCENTIVE CONTRACTING (14:8-9)

From a study conducted by the Logistics Management Institute, it was found that:

There is virtually unanimous agreement among managers and analysts who have studied overall contractor motivation that, in the short run, contractor management does sacrifice short-run profit on defense business in favor of achieving

1. Company growth,
2. increased share of the industry market,
3. better public image,
4. organizational prestige,
5. carry-over benefits to commercial business (commercial spinoffs),
6. greater opportunity for follow on business, or
7. greater shareholder expectations for future growth and profit.

Obviously, industrial firms cannot sacrifice short run profit on a continuous basis. However, the study goes on to give reasons why a company will accept a loss (or low profit or fee) if doing so provides an opportunity to

1. gain competitive advantage by engaging in developmental effort in areas of potential future business,
2. acquire or retain competent personnel in scarce disciplines,
3. spread fixed costs over a substantially broader base, or
4. prevent a potential competitor from gaining entry to the market.

They also point out that the remuneration of managers, as well as their prestige and professional stature, is more dependent on company sales than on profit rate. They summarize by stating:

Whether management is operating in the company's interest or for its own personal gain, it does not attempt to maximize profit or fee on individual contracts. It attempts to optimize among many objectives, placing particular stress on those which contribute most to maintaining or improving market position and assuring the future strength of the firm. The drive for profit is not absent, but is constrained by aims which ultimately are more consequential.

Fox, in his book Arming America, sums up much of what has been found in these studies. (15:467) He points out that:

Profit is not a defense contractor's only concern when bidding on or conducting a development or production program. Defense contracts are sought to cover payroll and overhead costs, and to provide company personnel with the opportunity to develop technical and managerial skills useful in commercial and defense business. Once a contract is won, a company seeks every opportunity to add work and funds to the program. The need for follow-on work is crucial, since (1) the initial effort to secure a contract involves a large outlay of money, and (2) there is usually a long time lapse between contracts for the same weapon system.

Summary

In this section, motivating factors such as sales growth, technical growth, market share, prestige and survival were identified in addition to profit. We must be careful in completely accepting these factors as the making of weapon systems is a dynamic business and a future scheme based on past factors could have serious shortcomings. Nevertheless, these factors form the structure of our data base. The task of comparing contractual incentives from Section II and these motivational factors will be addressed in the next section.

SECTION V

Incentives vs. Motivation

In Section II, contract incentives were found to be necessary elements of the military-industrial interface because they (1) share the risk of development programs, (2) communicate DoD's objectives, (3) allow the contractor to make cost, performance and schedule trade offs, and (4) help fill the gaps in a free enterprise market. From Section IV, contractor motivation was found to extend beyond the desire to make profit. Factors such as company growth, share of market, public image, shareholder expectations, technical growth, survival and carry-over benefits were recognized as playing an important role. Incentives are integrated into the contractual structure through increased or decreased profits or fees. Is this approach compatible with contractor motivation?

Do Incentives Work?

A quote collected by Hunt from the remarks of a large aerospace-electronics firm points out the limiting aspects regarding the operation of contractual incentives. (12:266)

...in reviewing the events of the past few years involving (the) performance of major aerospace contractors...there is one motivation that stands out above all others. This is the determination of a major defense contractor to design and produce a product, which, when held before the TV cameras and newspapers of the nation, will perform 100% the first time. This stems from concern over his continued success in the defense marketplace and the realization, in the case of many with commercial enterprises, that any tarnish on the corporate image may lead to a damaging decline in acceptance of the company's commercial products. Genuine concern over technological leadership and the quality of the country's defense capabilities are also major factors....

There is no cost incentive which will deter the contractor from incurring costs to assure successful performance; nor are

the cost, performance and delivery incentives as strong a motivation as the contractor's own determination to achieve successful performance. Examined in the light of the cost target for any one contract, this may appear to be flouting intended controls. Consider, however, that a spacecraft which fails in its mission and wastes a booster has cost the Government many millions of dollars. In most cases, the flight has to be repeated. The experienced loss is far greater than the extra money that might have prevented the failure.

While most DoD failures are not as spectacular as a manned spaceflight failure, this element of public acceptance and approval must certainly be important. Current examples are the Lockheed C5A and Grumman F14A programs. Corporations cannot afford this kind of publicity.

An extensive study of the incentive contracting period from 1963 to 1969 was conducted by Belden in preparation for his doctoral degree. (16:13) He concludes that "defense procurement outcomes in the incentive contracting environment have not reflected well on the use of incentive contracts." He found that firms and contracts included in his analysis did not evidence the results associated with the "cost responsibility" theory of incentives. For instance, he could find no conclusive relationship between the percentage change in target cost and the size of the contractors sharing ratio. Also firms which were primarily government contractors evidenced no relative increases in his selected management indicators over this period of time.

An effectiveness check on incentive contracts was conducted by Fisher for RAND in the mid-sixties, (17:vi). He finds that cost overruns were in fact less frequent on Air Force incentive contracts. However, he observes that the observed underruns do not seem to be related to the incentive features of these contracts. Since cost underruns appear to be no larger for contracts with large sharing rates than for those with small ones, he

suggests that incentive contracts have not had an important effect on contract costs or on contractor performance. He implies that contractors merely raised their target cost thereby increasing the probability of a cost overrun. While not discounting the usefulness of incentive contracts, he makes the point that they require a "good" going in target cost.

From a statistical analysis of all FPI contracts at Naval Air Systems Command over a fifteen year period, Dixon finds that there is repeated failure of empirical evidence to support the supposed effectiveness of the sharing ratio. (18:51) He concludes:

Since the cost incentive is the cornerstone of incentive contracting and incentive contracting is in extensive use today, it is a little disconcerting to find no empirical evidence to support it, i.e., percent deviation from target cost is not statistically related to the sharing ratio. It would seem prudent, lacking supportive evidence, to not place such dependence on incentive contracting to influence efficient contractor performance. Faith in an unprovable principle has its place in religious matters but not, in the author's view, in matters of economy and national defense.

The Logistics Management Institute, in a report published in 1968, lists findings from their selection of the most objective and thorough inquiries into the effectiveness of incentives. (14:11) They are the efforts of Booz, Allen and Hamilton (for NASA), Dr. Cherian, the Defense Science Board, Professor Hill, Colonel Jones, and Professor Scherer. Eleven major findings were listed, seven of which were unfavorable to incentive contracting:

1. Extra-contractual considerations dominate over profit or fee.
2. No significant correlation can be found to exist between cost sharing ratios and overruns or underruns.
3. Incentives have not been significantly effective as protection against cost growth on programs.
4. Contractors establish upper limits on profit on government contracts. A large profit or fee on a contract arouses

suspicions of cost padding and profiteering, making future negotiations more difficult.

5. Incentives are costly to negotiate and administer. The complexity of making a change is increased.
6. Contractors will not sacrifice performance attainment for profit, due to future company image.
7. It is often difficult to pass incentive motivation to the people who carry out the contract effort.

On the favorable side:

8. When a contractor discovers that his incentive arrangement does not correspond to the government's interest, he ignores the incentives.
9. Incentives serve as a planning discipline for DoD personnel.
10. Incentive structure clearly communicates the government's objectives to the contractor.
11. When it is possible to associate activities of individuals with specific contracts, incentives provide a useful tool for motivating workers.

They find that there is no compelling evidence that cost incentives are working. Concerning the contractors capability to make cost, performance and schedule trade offs, they state that as the program progresses, opportunities to adopt new technical approaches rapidly diminish. Pursuing parallel courses of action is extremely costly, and is seldom done. The key contractor trade offs are made prior to signing the contract, execution is restricted to relatively minor adjustments.

The Logistic Management Institute studies conclude "Hence the utility of performance incentives is severely inhibited."

From the data collected by these studies, one must conclude that incentives based on contractor cost control attitudes are not effective for many reasons. Fox, in Arming America, gives the following reasons for this apparent failure: (15:471)

1. A cost-based profit policy encourages contractors to boost costs.
2. Frequent contract changes during ongoing programs make cost reduction incentives negotiated at the beginning of a program meaningless. With each contract change, the contract price and other provisions are renegotiated.
3. The Government usually agrees to subsidize contractors' overhead expenses.
4. Contractors negotiate follow-on contracts.
5. The Government does not enforce contract provisions.

Needless to say, the measurement of the usefulness of contract incentives is difficult. On many outcomes, especially successful contract relationships, the reasons for success cannot be exactly identified. Likewise, for identified failure outcomes, the reasons for failure are not always clear. The evidence would seem to say that incentives work well at times and not so well at other times. Perhaps the reason can be associated with the target of our so-called incentives, that is, profit. If profit is not the primary motivating influence of a corporation, then obviously incentives based on the profit motive will not be effective. Other motives which can be identified are survival, growth, share of market and prestige or image. While these are not an all-inclusive list, these would appear to be the most basic and other motives could be considered as subsets of these.

Corporation Hierarchy of Needs

Once accepted as the basic motives of corporations, how do these motives interact and how does one identify the primary motive of a corporation? First, let us define a motive as a "need" or "drive" of a corporation. Now, just as Maslow established a hierarchy of needs for individuals, we can establish a hierarchy of needs for corporations, Figure V-1.

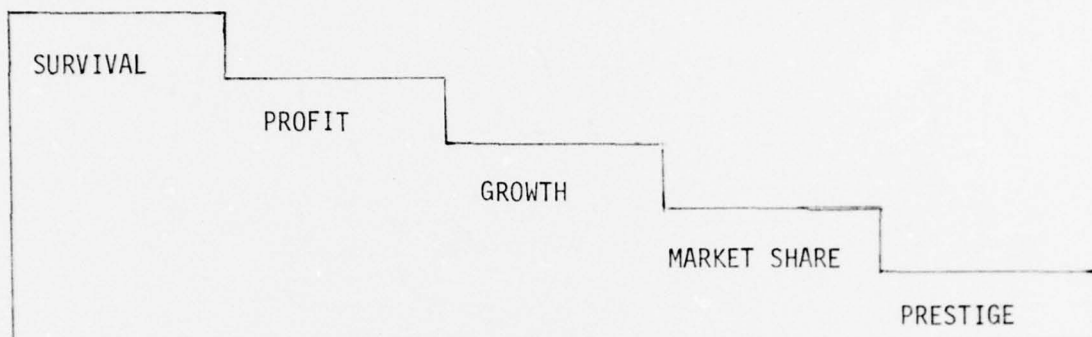


Figure V-1

Survival is identified as the most basic need. This is nothing more than a restatement of the "going concern" principle of all business corporations. Once the survival need is satisfied, profit will become the primary need or drive of the corporation, Figure V-2.

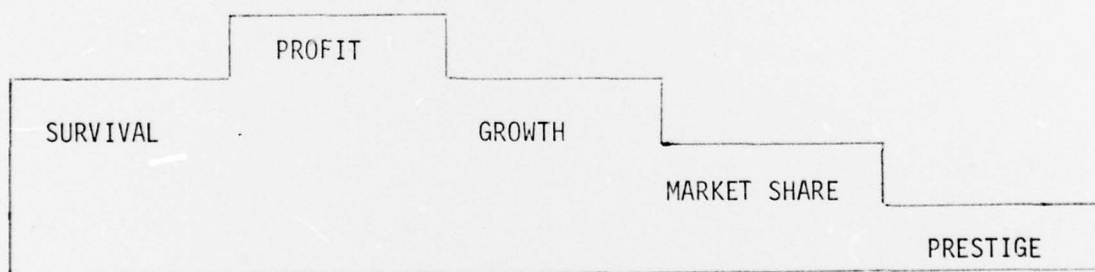


Figure V-2

As pointed out in many of the results of the referenced studies, profit is not always maximum profit but is usually referred to as adequate profit. Many firms, especially large defense contractors, are satisfied with 4-8% profit on defense contracts. With a satisfactory profit level, growth becomes the primary need. The hierarchy now appears as shown in Figure V-3.

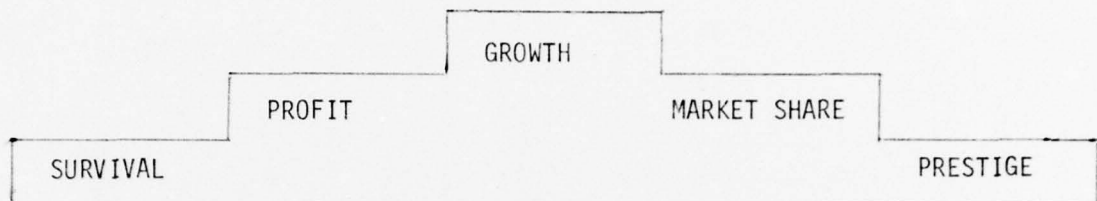


Figure V-3

Growth consists of two distinct types, growth of sales and growth of technical capability. Growth of sales can be measured by increased cash flow and by increased assets. In terms of government contracts, growth is associated with more contracts and larger target costs. Note that with the profit need satisfied, greater size contract costs become the driving motive. This will tend to explain why some firms will spend to target cost and beyond at the expense of a share ratio loss of profit. The other aspect of growth, namely technical capability, is also very important to a defense contractor. Most DoD contracts are labor intensive and highly technical in scope. Highly educated and qualified personnel are very important to the growth of a DoD contractor, therefore, sacrificing profit share may be attractive to a contractor relative to maintaining and increasing technical competence.

Once a corporation is established with adequate profit and desired growth rate, the market share need becomes more prepotent as shown in Figure V-4.

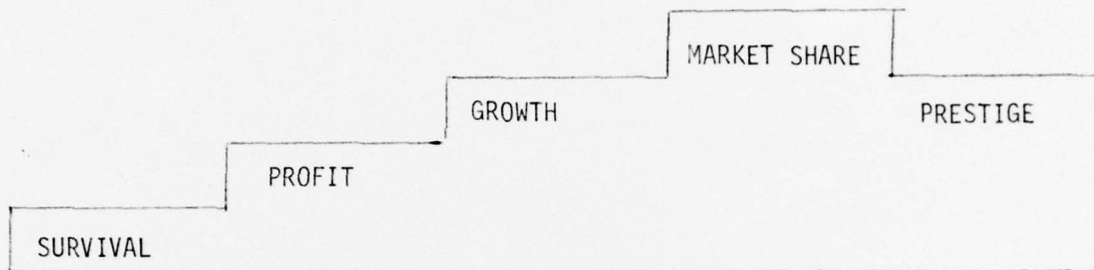


Figure V-4

At this point in the hierarchy, the corporation wants to be more than just a member of the group. It wants to be number one in total sales or in the case of defense contractors, it wants the largest share of the market. It is then recognized by measurement as being the largest in a particular field. Advertising slogans such as "we are number one" or "we try harder because we are number one" emphasize this important need of corporations operating at this level. Once the number one status is achieved, a strong drive exists to maintain "status quo" at the expense of other needs such as profit and growth. A corporation at this level will ride the "crest of the wave" and enjoy the power of being the leader in the field. With the market share need fulfilled, the hierarchy reaches its final step, Figure V-5.

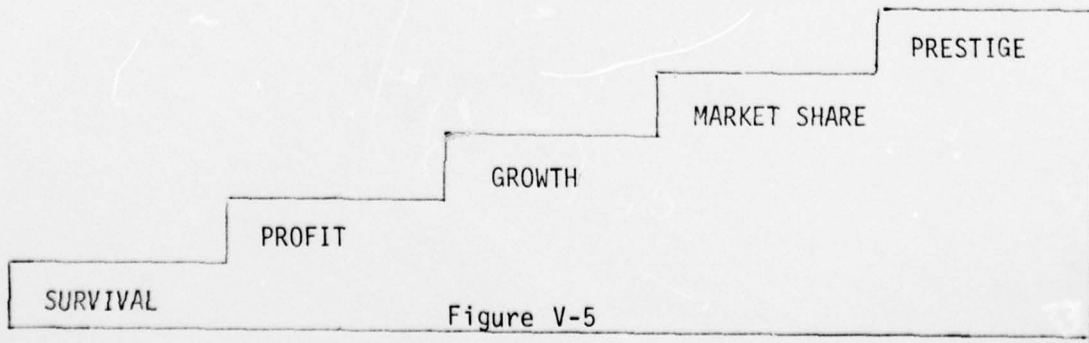


Figure V-5

Satisfaction of survival, profit, growth and market share needs gives a firm the feeling of self-confidence, power and control. The only remaining need is prestige and image of providing the best product or service. Firms operating at this level will stress the value of their warranties as an indication of the confidence they have in their product. As an example, Cadillac probably does not strive for more profit, growth or market share as long as they are confident that they have the most prestigious automobile. Prestige has become their most important drive. Just as self-actualization is the desire to become what one is capable of becoming for an individual, prestige is the desire of a corporation to become what it is capable of becoming. As an example, the prestige within the defense aircraft industry has gradually shifted in the years since WW II. While not measurable in numeric terms, a composite subjective evaluation would easily identify the current leader.

Now, if a firm is operating at a certain level, this does not discount the other levels as having some influence. Maslow's model is reshaped to show relative importance of needs of individuals. Applied to our case, the model for a firm operating at the survival level can be shown as Figure V-6a.

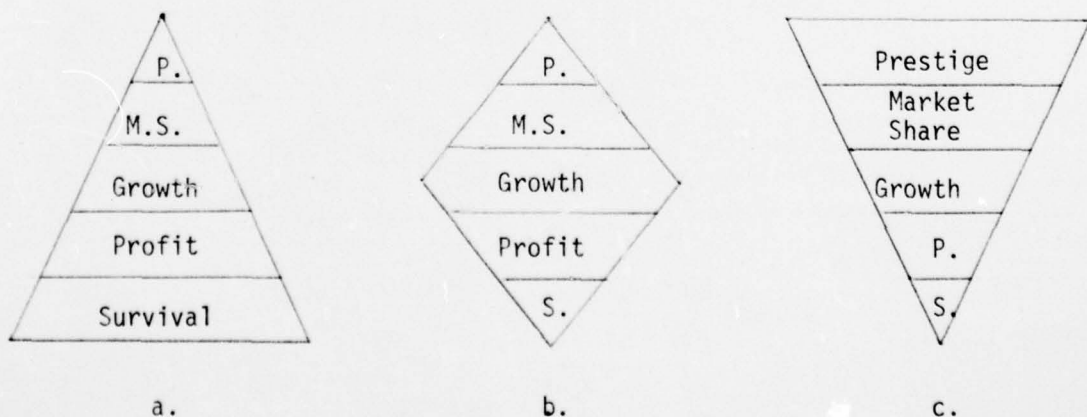


Figure V-6

The relative strengths of the needs for corporations operating at the growth level and prestige level are as shown in Figure V-6b and c respectively. From this model shape, we can easily see that the needs of one level do not have to be completely satisfied prior to the next higher level need becoming predominant. The needs of all levels are operating continuously, with emphasis on the basic need of that firm's operating level.

Contract Incentive Structure

Accepting this model as a representation of the real world does not complete our task. Now we must identify our potential contractor with an operating level and structure our incentives accordingly. The identification portion of this problem will be left to the judgment and industry of the reader. The government should have more than adequate knowledge about their potential contractors to be able to place them at the proper level.

A contractor operating at the survival level will be desperate for any business it can acquire. Motivation should not be a difficult task; they will be very anxious to do a good job. Caution should be taken in offering profit incentives on cost reducing efforts. This contractor will probably forego profit to keep his employee base at some minimum level; once he loses his technical expertise, he is gone.

A contractor operating at the profit level can obviously be incentivized through the normally accepted methods. The caution here is that probably very few defense contractors are at this level. Due to the entry restrictions on becoming a DoD contractor, a firm is probably operating at a higher level before they decide to enter the defense arena. Therefore,

a defense contractor operating at this level is probably slipping through on the way to survival.

The growth level is probably the most common level for defense contractors. A firm operating at this level can be incentivized by offering possibility for growth in return for performance. Profit need only be kept at the acceptable level. A reward framework where a contractor could earn the right to do future business with DoD would work well for incentivizing this level. One proposed approach is offered by Scherer in his Economic Incentives volume of The Weapons Acquisition Process. (19:401). The contractor's performance record would be evaluated on a regular basis and level of effort quota assigned to him relative to his competition. Additionally, the results of these evaluations would be published so that the recognition aspect is included. The contractor would always know where he stood in relation to his competition. He would not be inclined to realize maximum cost (sales growth) on a contract because he would be awarded future growth for holding down present costs.

The market share level is an extension of the growth level for incentivizing purposes. The additional factor is that you can motivate those firms who are number one in their area of technical competence by ensuring that they will remain on top with continued best relative evaluations. Evaluations would need to include all the aspects of cost, schedule and technical performance criteria.

Rewarding contractors operating at the prestige level can be accomplished in many ways, the only limit is one's imagination. Examples include establishment of Distinguished Defense Industry Board where selected corporations participate as advisors to the Secretary of Defense

for procurement matters. Or special awards in the form of bonus payments to employees of top defense contractors could be paid instead of the current method of awarding increased corporation profits.

In summary, the hierarchy of corporate needs has identified conditions where the target of contract incentives should be other than profit. It identifies the complexity of corporate motives and attempts to order these basic "drives."

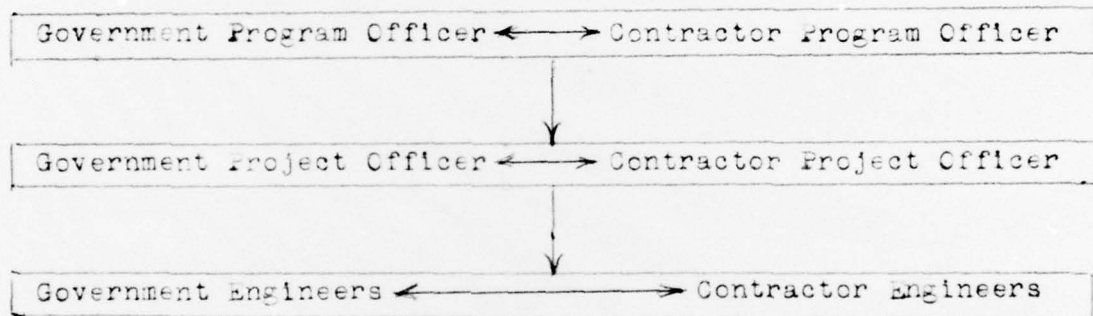
Military-Contractor Interface

One important aspect remains, to establish the best possible relationship between the government and the contractor for performance of the designated task. The "military-industrial complex" has been the target of much abuse in recent years. The complex has been accused of various infractions of real and/or implied laws and regulations. Even President Eisenhower warned the United States public of the excessive strength and power of the "military-industrial complex." Congress and the GAO are constantly checking the relationship to ensure that irregularities do not occur. The result of this concern and publicity has produced an adversary relationship in many cases, the government and contractor representatives are wary of establishing close relationships.

The task of building a major weapons system, from conceptual phase to production phase, is very complex and requires constant supervision and many management decisions. The Program Manager is given the overall responsibility for the weapon system. He in turn must rely on a contractor to build and deliver the hardware. To require the program manager's organization and the contractor's organization to operate at arms length and only within the legal restraints of the formal contract is not the "way to run a railroad." Nearly every Program Manager who has visited at

the Defense Systems Management College has stated that as the relationship with the contractor becomes closer, the task becomes easier and the results are better.

Hunt and Rubin have discussed this relationship in an article which was published in the Academy of Management Journal. (20:304). They discuss various adaptations of managerial modes and a "shared leadership" form is postulated, see Figure V-7.



Shared Decision Leadership Model

Figure V-7

The authors argue that separating managerial and regulatory controls in an R&D environment with technological uncertainty and environmental instability is ill advised. They state "a more feasible alternative mode of synthesizing goals, which ensures flexibility in the face of unexpected contingencies and opens communication channels while maintaining performance motivation and reducing interpersonal strain, is some form of cooperative management." With this model, unilateral decision making gives way to discussion, negotiation and compromise. The success or failure of the end product is shared by both organizations, why not legitimize the relationship with a formal "shared leadership" approach. The authors point out

that this method of making decisions will result in three types of psychological bonds - mutual dependence, respect and sentient ties and familiarity. Many Program Managers and staffs probably operate in close approximation to the Hunt & Rubin model. However, for the model to be effective, the Department of Defense must recognize the value of inter-organizational relationships and formally bless this approach.

Summary

In this section contract incentives have been compared with contractor motivation. In general, it appears that the government attempts to motivate the profit drive of the contractor. On the other hand, the contractor has many motives for securing a government contract, only one of which is profit. A hierarchy of contractor motives was developed in the likeness of Maslow's hierarchy of personal needs. Finally, a "shared leadership" model was proposed for establishment of the government-contractor relationship.

SECTION VI

Summary and Conclusions

This study project has compared the Department of Defense (DoD) incentive contracting factors with the motivational needs of the contractor. The subject is considered by the author to be vital to the success or failure of the relationship of the government and the contractor as formally bonded in the form of a contract. The Department of Defense is dependent on private industry for providing our weapons systems. The defense industries need the governments business to survive, to make a profit, to grow and to maintain the requisite technical base for the country. The result is a highly interdependent relationship which has been labeled "the military-industrial complex."

In Section II, the government's viewpoint of contract incentives was explored. This viewpoint developed in the late sixties and the basic mechanism has carried through until the present. The primary purpose of contract incentives is to communicate the DoD's objectives to the contractor's management through appealing to the profit motive of the contractor. He is encouraged to make tradeoffs between cost, performance and schedule with a related reward of increased profit or fee. A review of three current contracts in Section III found that the contract cost share line was utilized on all three contracts. Two contracts were for development of major weapon systems and included Design-to-Cost goals with corresponding share lines for adjustment of fee relative to the negotiated goal. Award fee provisions were contained in both contracts with increased fee in return for satisfactory performance in increasing reliability and maintainability aspects and for reducing life cycle costs. The third

contract was a production contract and included only a value engineering clause in addition to the cost share line incentive. It is apparent that profit incentives are a major part of today's contracts for weapon systems.

In Section IV, the results of several studies were reported concerning the needs or motives of industrial corporations who specialize in government contracts. It was found that just as an individual, a corporation has a complex and time-dependent motive structure. In addition to profit, the management of defense industries are concerned with company survival, sales growth, technical capability growth, market share, prestige and public opinion.

In comparing contract incentives with contractor motivation, it was found in Section V that little evidence exists which indicates that contract incentives do in fact motivate contractors to control costs or make trade offs between cost, schedule and performance. Contractors are found to be performance oriented and will not in general trade off costs at the expense of performance, especially when increased costs are associated with company growth. As a basis for a better understanding of contractor motivation, a hierarchy of needs was proposed. The conclusion was made that most defense contractors are operating on a hierarchy level with growth or market share as the dominant motive or drive. This conclusion tends to explain the apparent failure of incentives based on the contract profit motive.

Some recommendations were proposed to cope with contractor motives at each level on the hierarchy. Incentives should be tailored to each corporation to match their needs or drives. The last major conclusion of this study is that the government-industry interface is strained by formal

regulations and Congressional and public opinion. A shared-decision leadership model is offered as an initial step to bind the government-contractor interface.

A review of the total weapon systems acquisition process seems to indicate that: a. Congress is critical of the process as being too time-consuming and too costly and wasteful; b. Industry is unhappy with the rules and regulations under which they are forced to operate; and c. The DoD is continuously making changes to the existing weapons acquisition structure in piecemeal fashion. Perhaps it is time to develop a new acquisition process. This can only be done by erasing all of the current restrictions and structuring the new concept from an "ideal" basis, one in which industry, Congress and the DoD share the concept development burden.

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