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An Evaluation Of Incentive Provisions In Government Contracts.

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AN EVALUATION OF INCENTIVE PROVISIONS IN GOVERNMENT CONTRACTS

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CHAPTER I

INTRODUCTION

I. THE PROBLEM

In the past decade, beginning near the termination of the Korean conflict, an ever increasing percentage of defense appropriations has been going toward basic development work--primarily the development of weapons and interrelated defense systems. Traditionally, this type of work has been contracted for on a cost-plus-fixed-fee (CPFF) basis, the dollar amount of which has been rising steadily. In fiscal year 1953, for example, 15 per cent of all Department of Defense (DOD) procurement was on a CPFF basis, while in fiscal year 1962 the figure rose to an all-time high of approximately 38 per cent, or $10 billion.[1]

This pyramiding volume of CPFF contracting has become a matter of great concern to the present Administration and the DOD in particular. The reason for this concern lies in the thesis that a CPFF contract stifles the influence of the "profit motive"; a contractor performing under

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[1]Graeme C. Bannerman, "New Procurement Management Trends: A Department of Defense View," The Federal Accountant, Vol. XII, No. 1 (September, 1962), p. 123.

a CPFF contract has little or no incentive to control costs, improve delivery schedules, increase reliability or performance, or even take minor risks.

In actuality, this form of contracting may provide an "inverse"[2] incentive, both with respect to cost control and with respect to product performance and timeliness of delivery. The advancement of this viewpoint lies in the fact that in the CPFF contract the fee remains static, as "good" and "poor" performances are rewarded equally in terms of absolute profit dollars. These absolute dollars tend to produce low rates of return, reflecting the relatively minor risk which the contractor assumes.

Thus, the CPFF contract not only fails to provide incentives for economy, but may actually deaden management efficency since neither the contractor nor the DOD needs to estimate costs accurately or control programs tightly. The prime financial focus centers on allowable costs and reasonable fees rather than on total price and exclusion of avoidable costs.

It is primarily because of these weaknesses that considerable governmental effort is being applied to reduce

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[2]An "inverse" incentive is defined as one which promotes a result opposite to that which was originally intended.

the use of CPFF contracts. Thus a shift to incentive-type contracts is taking place.

II. PURPOSE OF THE THESIS

With the general inadequacies of the CPFF arrangement having been discussed above, the problem now becomes one of determining whether these deficiencies can be remedied through the extensive use of incentive-type contracts. The incentive arrangement rewards the contractor with additional profit dollars if he can better established cost, schedule, and/or performance goals; the contractor is in turn penalized through a decrease in profit dollars if he fails to meet or better the goal(s). In brief, the incentive principle holds that the contractor should be motivated through the application of the "profit motive" to:[3] (1) produce a product which meets or exceeds significantly advanced performance goals; (2) improve upon the delivery schedule or progress of significant events; (3) reduce costs of the work by substantial amounts; or (4) carry out the performance under a weighted combination of some or all of these objectives.

Incentive contracting regulations are contained in Revision Number Eight to the Armed Services Procurement

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[3]Office of Assistant Secretary of Defense (Installations and Logistics), Department of Defense Incentive Contracting Guide (Boston: Harbridge House, Inc., 1962), p. 2.

Regulation.[4] However, it is primarily the Department of Defense Incentive Contracting Guide which will be employed as the base from which to begin the evaluation of the incentive approach to contracting; it is policy, not regulations per se, which will ultimately determine the success or failure of the incentive approach.

The purpose of the thesis is to examine and evaluate the role that the incentive provision(s) can play in the cost-plus-fixed-fee area specifically, as well as in the governmental contract area in general.

III. METHOD OF PROCEDURE

Examining the arguments for and against the extensive application of the incentive principle involved the reading of many articles, both pro and con, concerning the relative merits of CPFF and incentive-type contracting. Though many of the articles were written by governmental personnel, a good portion were also authored by industrial management officials, thus enabling both the government's and the contractors' viewpoints to be considered.

Along with this background reading on the subject, interviews were held with officials of the Atomic Energy

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[4]Department of Defense, Armed Services Procurement Regulation (Washington: Government Printing Office, 1948-1962), Revision No. 8, March 15, 1962.

Commission, an agency which has just recently entered the incentive contracting field. Especially helpful were talks with Mr. A. A. Vergari, Director, Finance Division, and Mr. Lawrence Brighton, Contractor Administrator, of the San Francisco Operations Office.

Of significant value also was an interview with Mr. Frank Peel, Deputy Assistant Manager for Administration, Albuquerque Operations Office, Atomic Energy Commission. Discussion with him concerning his experience in negotiating a cost-plus-incentive-fee contract was of considerable worth in the preparation of the thesis. In addition, Dr. John McMahon, Associate Chief, Accounting Branch, and Mr. Richard Torres, Chief, Accounting Liaison Branch, offered considerable assistance during the early stages of problem formulation and definition.

Interviews were also arranged with officials in private industry concerning their opinions of the incentive approach to contracting and its ramifications in relation to their respective firms. Although two such interviews were held with officials of California based firms, reluctance to disclose data or offer quoteable information rendered the interviews of little value as far as furthering the thesis research.

Through the analysis of the information and/or opinions garnered from both primary and secondary sources,

conclusions will be reached pertaining to the effects of incentive provisions in government contracts, with specific emphasis on the development contract situation.

CHAPTER II

BACKGROUND ON GOVERNMENT CONTRACTING

I. OBJECTIVES OF GOVERNMENT CONTRACTING

The basic emphasis of federal government contracting is no different from that of the average person or business firm--that is, to secure the best value possible for the money and effort spent.

However, it is interesting to note that financial management philosophy and objectives vary widely between government and industry. Financial management in government is concerned with the planning, allocating, controlling, analyzing, and adjusting the use of its financial resources.[1] It must secure adequate appropriations from Congress, spend the appropriations as economically and efficiently as possible, and account fully for these expenditures. When decisions are challenged, government financial managers must prove that the government received the most for the least, with no room for waste or inefficiency.

Conversely, industry's financial management operates on an enterprise concept.[2] Its product must be priced low

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[1]Robert E. Beach, "New Procurement Management Trends: An Industry View," The Federal Accountant, Vol. XII, No. 1 (September, 1962), p. 133.

[2]Ibid.

enough to meet or beat out competition, yet high enough to cover performance costs, with enough margin remaining to buy new production facilities, support research and development, and pay interest and dividends. The ultimate test in industry, then, is not one of stewardship of funds, but instead centers around the final figure on the income statement.

This basic difference in purpose has either caused or aggravated many of the problems facing both government and industry today, particularly in the areas of financial reporting, cost estimating, and cost analysis. It is this basic difference in purpose and objectives which should be kept in mind when considering and examining the many facets of governmental contracting policy.

To achieve its objective of receiving the best value for the money and effort spent, the government utilizes two methods of procurement: procurement through formal advertising and procurement through negotiation. Contracts let through formal advertising may be only of the fixed-price or lump-sum type, and are let through use of open advertising for bids with the ultimate award of the contract going to the lowest responsible bidder. This type of contract is used mainly for the purchase of raw materials, food, and clothing of reasonably standard requirements. However, since this method of procurement does not make use of the incentive principle per se, it will not be further considered in the thesis.

II. PROCUREMENT BY NEGOTIATION

Contracts entered into by negotiation may be of any type consonant with the "best interests" of the government, except that under no circumstances shall a cost-plus-a-percentage-of-cost (CPPC) type be used.[3] The CPPC type of contract was first resorted to during World War I when contractors would not agree to firm fixed-price contracts because of rapidly rising costs and prices at that time.[4] The employment of the CPPC contract thus shifted the risk of rising costs from industry to government. The contractor was allowed a profit based on a percentage of actual cost; these contracts gave contractors an incentive to increase costs to the full potential, so that fees would increase accordingly. As a result of this inversed incentive, the CPPC approach to contracting was soon declared illegal.

Explanation of the most widely used forms of negotiated contracts are set forth briefly in the following paragraphs, divided into two distinctive groups: fixed-price and cost-type.

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[3]Paul M. Trueger, Accounting Guide for Defense Contracts (Chicago: Commerce Clearing House, 1953), p. 27.

[4]Irving Kalikow, "Defense Incentive Contracting: Incentive Contracting in Principle," The Federal Accountant, Vol. XII, No. 3 (March, 1963), p. 63.

Fixed-Price Contracts

The most desirable type of contract, from the governmental point of view has always been held to be one which is subject to a firm fixed price, because the price is established before the contract is executed.[5] This pre-performance pricing effects the greatest incentive for efficient production because the contractor keeps all he saves and must pay for overruns out of his own operating funds. Utilization of the firm fixed-price contract also permits better budgetary control since the cost to the government is known. Furthermore, the cost of administering this type of contract is much less than for other types.[6]

When previous experience or other elements permit the negotiation of a fair price and where no unusual cost fluctuations are expected, a firm fixed-price contract will generally be executed; the contract will not include any repricing provisions. However, in the instance of contracts for supplies similar to the contractor's standard product, a provision may be included for price escalation. Under this provision, the contract may be opened for repricing should changes occur in the price structure of purchased

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[5]Kalikow, op. cit., p. 66.

[6]Ibid.

materials or should wage levels increase over those prevailing at the contract execution date.

When more substantial uncertainty exists as to the ultimate cost of contract performance, a provision for price redetermination may be inserted in the fixed-price contract; hence, the contract no longer is of a firm fixed-price nature, but instead becomes a fixed-price contract subject to renegotiation (FPR).

The FPR contract type may be considered appropriate when more pricing information is available than would justify the use of a cost-reimbursement contract, but not enough pricing information is available to allow the use of a firm fixed-price contract. Several types of FPR contracts are in use, but they generally fall into three main categories: retroactive price redetermination only; retroactive and prospective price redetermination; and prospective price redetermination only.

The redeterminable fixed-price contract has not been successful in accomplishing cost reduction because of its similarity to the cost-plus-a-percentage-of-cost contract. Retroactive repricing ties profits to historical costs and thus induces the contractor to inject as many costs as possible into the contract. Prospective repricing (fixed-price ceiling is determined after the contract is partially finished) is sounder in concept but has often been accomplished

so late in practice that it has had many of the features of retroactive repricing.

Consequently, Revision Number Eight to the Armed Services Procurement Regulation severely limits the application of retroactive repricing and allows prospective repricing only when there is reasonable assurance that price redetermination will actually be undertaken promptly at the time or times stated.[7]

Cost-Type Contracts

Three basic cost-type contracts are used by the government: (1) cost (and cost-sharing); (2) cost-plus-fixed-fee (CPFF); and (3) time-and-material.[8]

The cost contract is used for the procurement of services and/or supplies; the contractor is reimbursed for allowable costs (set forth in the contract), but allowed no profit. This form of contracting is generally employed for research and development work with educational and other non-profit institutions.

The CPFF contract differs from the cost contract in that it also provides for the payment of a fixed fee based

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[7] Department of Defense, op. cit.

[8] Trueger, op. cit., p. 33.

on the estimated contract cost. This fee will not vary with actual cost, except as a result of a change in the scope of work under the contract. The government is well aware that the contractor assumes little risk under the fixed-fee contract and, accordingly, the profit percentage will generally be lower than that obtainable under a fixed-price arrangement.

The time-and-materials contract is of a hybrid nature, containing elements of both a cost contract and a cost-plus-fixed-fee contract. Its basic use is for the purchase of services on the basis of direct labor hours at specified rates (which include direct labor, overhead, and profit) and materials at cost. This type of contract might be used to secure engineering and design services in connection with the production of supplies, or for repair or maintenance services.

A review of the problems experienced with the various types of government contracts should clarify the importance and potential of incentive contracting.

III. COST AND EFFORT CONTROL PROBLEMS INHERENT IN NEGOTIATED CONTRACTS

The Cost-Plus-Fixed-Fee Contract

The cost-plus-fixed-fee contract (CPFF) has been traditionally applied when it was felt that accurate pricing

could not be achieved (most notably in the research and development area where contingencies and intangibles were operative over much of the contract's life span). Use of this type of contract has expanded with the increasingly complex nature of the nation's defense programs. In fiscal year 1961, for example, 13 per cent of DOD dollars was spent under CPFF contracts;[9] this percentage then spiraled to a high of 38 per cent during fiscal year 1962.[10]

In negotiating a CPFF contract, the participants must agree upon an estimated cost and then upon a reasonable fee. The dollar amount of the fee will not change upon the completion of the contract performance, even though actual cost may be significantly more or less than the estimated cost.[11] Thus, there is no incentive for the contractor to increase costs without good reason; yet, neither is there an incentive for him to reduce costs or to operate more efficiently.

Many costs that are allowable but avoidable may be incurred simply because the contractor finds it advantageous to keep employees busy or expand the technical knowledge of

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[9]Office of Assistant Secretary of Defense, op. cit., p. 2.

[10]"Changes Begin to Pay Dividends," Missiles and Rockets, Vol. 12, No. 12 (March 25, 1963), p. 33.

[11]However, changes in scope of the contract work may affect both estimated cost and dollar fee.

his personnel. In actuality, the only meaningful incentive may be the prospect of receiving additional contracts for volume production. Yet, if the contractor is not operating near capacity and does not expect to in the near future, he may purposely extend the contract time-wise, letting or forcing the government to contribute additional dollars to fixed expenses. In addition, there is the argument that the CPFF arrangement provides an incentive to inefficiency if costs are kept high on one contract to establish higher estimated costs and therefore higher fees on subsequent contracts.

There is also a tendency to continue a CPFF contract for an excessively long time because it is a "safe" type of contract for the government contracting officer to administer where competition is lacking.[12] The static fee makes it extremely unlikely that the contracting officer can be criticized for the contractor's making unreasonable profits, regardless of the outcome of the operation from a cost standpoint. The emphasis on this type of contract is on allowable cost and profit, not on total price to the government.

The consensus of opinion of those most familar with the CPFF arrangement is that it provides inversed incentives both with respect to cost control and to the quality and

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[12]Kalikow, op. cit., p. 64.

timeliness of product development. E. V. Huggins, Chairman of Westinghouse Electric Corporation's Executive Committee, states:[13]

> Frankly, it's awfully hard to lose money in this business. The risk isn't as great as it should be. The government doesn't have the means of judging good performance and poor performance, and penalizing it accordingly.

In addition, John H. Rubel, Assistant Secretary of Defense for Research and Engineering, believes that CPFF arrangements have led to large buildups of industrial organizations with a view more toward getting the contracts initially than toward carrying them out.[14] He feels that these contracts engender an atmosphere conducive to waste and mediocre performance generally.

An example of the extent to which contractors tend to "buy into" CPFF contracts initially has been cited by Representative Melvin Price (D.-Ill.), chairman for both the Joint Atomic Energy Committee and the Armed Services Committee.[15] He stated that in scanning a list of 100 National Aeronautics and Space Administration (NASA) projects, each originally estimated to cost $1 million or more, he observed

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[13]"Technology: A Place in Space," Time, Vol. LXXVIII, No. 17 (October 27, 1961), p. 93.

[14]Bannerman, op. cit., p. 124.

[15]"House Leader Cites R & D Mismanagement by DOD," Missiles and Rockets, Vol. 13, No. 20 (November 11, 1963), p. 18.

increases in cost in 90 of these, ranging up to a figure in excess of 1,000 per cent.

Industry also has a management responsibility, Representative Price noted. Since many large government contracts are awarded on the basis of certain talented personnel in the company, the diverting of these key personnel to other projects constitutes an unjustifiable break of moral obligation "if not a break of legal obligation." A CPFF contract does not provide the incentive for keeping these key personnel on the contracted work.

As an over-all effect, the extended use of the CPFF contract has seriously sapped both industrial and governmental efficiency. The government has not estimated costs accurately nor controlled programs tightly; neither has it provided the incentive for industry to control costs, improve delivery schedules, eliminate over-design, increase reliability, or even take minor risks.

As early as 1942, these serious defects inherent in the CPFF contract were recognized and a policy statement known as the "Tryon Statement" was issued on the subject by the Armed Service Forces.[16] This statement, in recognizing the weaknesses of the fixed-fee arrangement, specified that these contracts should be used only when there was no

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[16]Kalikow, op. cit., p. 65.

alternative. Nevertheless, the dollar amount of these contracts has continued to rise.

The Fixed-Price Contract

As mentioned previously, the most desirable type of contract from the cost control viewpoint has always been held to be one subject to a firm fixed price since the price is established before the contract is executed. Thus, the contractor has the greatest possible incentive for controlling costs because he keeps what he saves and must pay for overruns.

Fixed-price contracts are especially suited to cases in which the contractor possesses considerable skill and insight due to years of experience in manufacturing a product. When the contractor does not possess these traits, fixed-price contracting loses much of its advantage. To burden the contractor with uncertainties in these circumstances may result in the inclusion of a large amount for estimated contingencies in the fixed price. If the conditions of uncertainty are extreme, the contingency element may be so great as to completely overshadow the potential addition to profit the contractor could make through increased efficiency in operation, with the result that incentives to control costs are not of real importance.

Not only is there a prospect for the loss of incentives, but the possibility also exists for excessive profit

for the contractor. Contingencies which are adequate at the contract execution date may prove abnormally large if the contingencies fail to materialize. To the extent that the risks do not materialize, the government will benefit by assuming the risks itself.

Of course, it is possible that contractor losses will exceed contingency provisions, but it is unrealistic to expect that a contractor who has purported to assume such contingencies will, in fact, bear them. He may insist on rewriting the contract or he may default.[17] The point is that the government will bear the cost in any event; it might as well assume the risk in the beginning, rather than pay a premium to each contractor.

The Comptroller General has reported a case in which a contractor received a negotiated firm fixed-price contract for a newly developed product before adequate cost and production experience were available. As a direct result of the application of a firm fixed-price contract under the wrong circumstances, the contractor realized profit amounting to 49 per cent of cost.[18]

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[17]Richard A. Tybout, Government Contracting in Atomic Energy (Ann Arbor: The University of Michigan Press, 1956), p. 9.

[18]Ibid., p. 66.

Other Price Control Efforts

Congress has tried several different methods of controlling prices to the government, most of them through attempted profit control. The Vinson-Trammell Act of 1934 limited shipbuilding profits to 10 per cent of costs and aircraft construction profits to 12 per cent of costs. However, in effect this Act had the same deficiency as the cost-plus-a-percentage-of-cost contract in that profit was related percentage-wise to actual cost; thus, an incentive was created for the contractor to maintain higher costs. Also, risk assumed, capital investment, efficiency, and other factors were not considered as important in evaluating profit levels as they are today.

However, before the Act could be tested effectively, it was necessary to suspend it. In 1940, Congress was requested by the Council of National Defense to exempt procurement of military aircraft from the profit limitations; aircraft contractors had a large backlog of orders from England and France and would not accept United States government orders if a profit limitation was to be in effect. By November of 1940 all profit limitations under the Act were suspended for the remainder of the emergency.

Other price control efforts included price "ceilings" on certain commodities and an excess profits tax to recapture "excessive" profits through taxation. In April of 1942,

legislation was passed providing for the renegotiation of profits after contract completion by a government Renegotiation Board. After consideration of all "pertinent" contract factors, the Renegotiation Board may require a refund of profits to the government if the Board feels that profits were excessive. The contractor, in turn, may appeal Renegotiation Board rulings to the Tax Court.

None of the above methods of attempted price control reaches the crux of the problem. In the main, they are concerned with profit control and not with over-all price control. The core of the problem is not really one of profit control; over-all cost to the government should be the main concern of the contracting agency. In addition, the above efforts toward profit control do not provide incentives for cost reduction, more efficient production methods, or superior product performance.

IV. INCREASE IN THE USE OF THE INCENTIVE PRINCIPLE

As deficiencies were discovered in other types of contracts, greater emphasis was placed on incentive-type contracting as a means of providing encouragement for both cost reduction and superior contract performance. The incentive principle itself is not new to government contracting, however, as it was first used in 1908 when the Signal Corps applied a performance incentive in purchasing a plane from

the Wright brothers. The target speed was 40 miles per hour, while the incentive plan was ± 40 per cent of the contract price for ± four miles per hour.[19] The plane reached a speed of 42.25 miles per hour and the Wright brothers received a $5,000 bonus.[20]

During World War II, the Tryon Statement previously mentioned advocated the use of the bonus and penalty system to promote cost reduction efforts, and in 1945 a new incentive provision was added to the procurement regulation. This incentive provision established a target price, considered to be a reasonable price, and a maximum price, equal to the lowest price the contractor would accept if all contingencies were included. Specific profit percentages and cost ranges were negotiated for each contract and applied upon review of actual performance costs. The contractor's profit would increase by a percentage of the decrease in final cost as compared to target cost, but total price to the government would be reduced as it, too, would share in the savings. This technique was introduced too late to be of much use during World War II, however, and was not strongly stressed thereafter.

Several studies since World War II have recommended greater use of the incentive principle in order to obtain

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[19]Office of Assistant Secretary of Defense, op. cit., p. 1.

[20]Kalikow, op. cit., p. 68.

better quality products at lower prices. For example, in 1952 Arthur D. Little, Inc., reported following a management study contract with the Department of the Army:[21]

> It is believed that permitting contractors to be rewarded price-wise and to share in savings for good performance and economy of operation would be effective means to improve procurement.

Similarly, in June, 1955, the Task Force on Procurement of the Commission on Organization of the Executive Branch (Second Hoover Commission) stated that the basis of cost reduction efforts should be full utilization of industry incentives for increasing production efficiency and lowering contract prices.[22]

However, the real impetus to the incentive approach in contracting came in March of 1962, when the section of the Armed Services Procurement Regulation (ASPR) dealing with negotiated contracts was changed considerably by Revision Number Eight. The introductory note states in part:[23]

> Concern over the rising costs of weapons and military equipment has resulted in concerted and aggressive efforts to achieve cost reductions in procurement and has necessitated a complete re-evaluation of the policies governing the selection of contract types.

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[21] Ibid.

[22] Ibid.

[23] Department of Defense, op. cit., Revision Number 8.

> The over-all objective of assuring a fair and reasonable price is continued, but the contents of this revision are directed toward this objective by providing maximum incentives for superior performance by the contractor through the exploitation of the profit motive. To provide needed flexibility, a wide selection of contract types is continued. The order in which they appear has been rearranged in a significant manner in the order of decreasing cost responsibility of the contractor; from the firm fixed-price contract, which offers the maximum incentive to produce efficiently, to the cost-plus-a-fixed-fee contract where the incentive is minimal. Between these extremes are other contract types which provide varying degrees of contractor cost responsibility. As to these, it is required that those types be used which offer the greatest degree of cost responsibility available under the circumstances pertaining to each procurement.

As a direct result of this policy, CPFF dollar contracting volume slid from a high of 38 per cent of total DOD contracting dollars during the first nine months of fiscal year 1962[24] to 22.7 per cent as of June 30, 1963.[25] The DOD goal is to reduce the dollar volume of CPFF contracting to 12.3 per cent of total procurement by fiscal year 1965; this will require a shift of an estimated $6 billion to cost-plus-incentive-fee and fixed-price awards.[26]

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[24]"Changes Begin to Pay Dividends," loc. cit.

[25]Frank McGuire, "DOD Plans More Equitable Contracting," Missiles and Rockets, Vol. 12, No. 22 (June 3, 1963), p. 18.

[26]"Changes Begin to Pay Dividends," loc. cit.

Missiles and Rockets offers further evidence as to the extent of the DOD's incentive and cost-cutting drive:[27]

> In dollar figures, cost-plus-a-fixed-fee contracting was cut by $3.2 billion in fiscal year 1963 with savings estimated at 10 per cent, or $320 million.
>
> Firm fixed-price contracts increased from 30.4 per cent in the first nine months of fiscal year 1961 to 41.3 per cent in the first nine months of fiscal year 1963.
>
> Cost-plus-incentive-fee contracts rose over the same nine-month periods from 2.7 per cent to 10.7 per cent. Fixed-price incentive contracts increased from 9.7 per cent to 14.8 per cent in the same periods. Other types of contracts dropped from 19.2 per cent to 10.5 per cent as a result of the trend.

Thus, to stimulate industry performance, and give industry a chance to earn higher profits through superior performance, the DOD is applying incentives as rapidly and as widely as possible.

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[27] Frank McGuire, loc. cit.

CHAPTER III

INCENTIVE CONTRACTS

I. TYPES OF INCENTIVE CONTRACTS

The following definition of incentive contracting is offered by an accounting official of the Atomic Energy Commission:[1]

> Incentive contracting can be characterized briefly as direct standard costing in which the contractor participates in favorable variances and is penalized for unfavorable variances.

These standards are negotiated standards, and not necessarily engineering standards. If the variance from the negotiated standard is favorable, the contractor participates through an increase in profit dollars; if the resulting variance is unfavorable, the contractor will be penalized through a decrease in profit dollars.

The cost incentive takes the form of a sharing formula expressed as a percentage ratio. If the formula negotiated were 80-20, for example, 80 cents of every dollar "saved" (favorable variance) would revert to the government, while the contractor would retain 20 cents. Conversely, the

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[1]Interview, Albuquerque Operations Office, Atomic Energy Commission, March 5, 1964.

government would contribute 80 cents to every dollar over target cost (unfavorable variance), while the contractor's profit would decrease by 20 cents for every dollar of overrun. Thus, every dollar of cost overrun must be considered by the contractor as 20 per cent his. Profit or fee is tied to the contractor's control of variances--variances upon which his managerial skills can have a significant effect.

Similarly, test procedures and performance goals may be negotiated and incentive patterns arranged in these areas. Incentive targets might be tied to such items as range of a missile, thrust of an engine, or length of the product's useful life. As for delivery or schedule incentives, targets may relate to dates of completion of various elements of the contract, final delivery of the entire product or project, test completion, or prototype acceptance.

As a matter of policy, ASPR states that neither performance nor schedule incentives may be used without simultaneous operation of cost control incentives; the implied intent of this policy is to prevent over emphasis on performance or schedule objectives and resultant neglect of cost. However, cost incentives will often be encountered alone--that is, without simultaneous inclusion of performance or schedule incentives. (Normal contractual safeguards will be included for performance specifications and delivery dates.)

Of the three main types of incentives--cost, performance, and schedule--cost has had the greatest application in the past and is the simplest in concept. For this reason, and because the incentive principle works the same for all three incentives, the cost incentive will be used to illustrate the incentive principle in the two broad types of incentive contracts--the fixed-price incentive and the cost-plus-incentive-fee (CPIF).

When the cost incentive is used, in both the fixed-price incentive and the CPIF contracts, the contractor's final profit is based on the amount by which his actual costs exceed or are kept under target costs. "Actual costs" are negotiated on a fixed-price incentive contract; they are audited and then paid as "allowable costs" on CPIF contracts.[2] Once actual costs are determined, the final profit or fee is automatically computed in accordance with an already existing formula.

Fixed-Price Incentive Contracts--Firm Target

There are two basic forms of the fixed-price incentive contract--the firm target (FPIF) and the successive targets (FPIS). Under the FPIF form, the government and the contractor negotiate at the outset a target cost, a target profit, a

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[2]For procedure, the reader is referred to ASPR XV.

price ceiling (but not a profit ceiling or floor), and the sharing formula (the arrangement for establishing final profit and price).[3]

After contract performance, the contractor and the government negotiate the final costs of the contract, with the final contract price established in accordance with the previously agreed upon sharing formula. If final cost is less than target cost, final profit will exceed target profit; conversely, if final cost is greater than target cost, final profit will be less than target profit and will eventually result in a net loss if actual costs exceed the total price ceiling.

To illustrate the operation of a fixed-price incentive contract with firm target, the following data are assumed:

Target Cost	$1,000
Target Profit	100
Target Price	1,100
Price Ceiling	1,250
Sharing Formula	75/25

Under the sharing formula, the government would keep 75 per cent of every dollar under target cost, while the contractor would keep 25 per cent. If an overrun occurred, the government would pay 75 per cent of each dollar of overrun

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[3]Bernard B. Lynn, "Incentive Contracting in Operation," The Federal Accountant, Vol. XII, No. 3 (March, 1963), p. 78.

until the government reached a total price payout of $1,250; the contractor would pay 25 per cent of each dollar of overrun up to $250, and 100 per cent of each dollar of overrun thereafter. If, in the above example, the contractor reduced target cost from $1,000 to $900, he would receive 25 per cent of the $100 cost reduction, or $25, plus the target profit of $100, for a total profit of $125. The cost to the government would then be $1,025.

If, however, the contractor's actual cost totaled $1,100, he would pay 25 per cent of the $100 overrun, or $25. His profit would be:

Target Profit	$100
Less: contractor's share of overrun	25
Actual Profit	$ 75

Cost to the government would be:

Target Cost	$1,000
Add: government's share of overrun	75
target fee	100
Actual Cost	$1,175

If the total contract overrun reached $250, the contractor would receive no profit on the contract. The government's share of the overrun would be 75 per cent, or $187.50; the contractor's share would be 25 per cent, or $62.50. The ceiling price of the contract is $1,250, so the government would contribute as follows:

Target Cost	$1,000.00
Government's share of overrun	187.50
Since the $100 target fee would bring the total price above the ceiling price of $1,250, the government would contribute only	62.50
Price Ceiling	$1,250.00

Since the fee received by the contractor ($62.50) would equal the amount contributed by him to the overrun (also $62.50), the net result to the contractor would be no monetary profit on the contract performance. Any cost over the $1,250 ceiling would, of course, result in an actual loss. But, since there is no profit ceiling either, profit would also continue to increase regardless of the amount by which target is underrun.

Fixed-Price Incentive Contracts--Successive Targets

Under the fixed-price incentive contract with successive targets (FPIS), it is possible to re-establish targets at various points throughout the contract performance--i.e., "retargeting." This type of contract is used primarily when realistic pricing information is not available for the initial negotiations, but is expected to be available, either from this or similar contracts, during the early stages of performance. The parties start the contract by negotiation

of the following elements:[4] initial target cost, initial target profit, initial profit ceiling and floor, formula for fixing the firm target profit, price ceiling, and production point at which the formula will be applied. For illustration, assume the following figures:

Initial target cost	$1,000
Initial target profit	80
Initial profit floor	70
Initial profit ceiling	90
Price ceiling	1,300
Sharing formula	95/5

When the contract performance point for formula application is reached, a firm target cost will be negotiated based upon more realistic or up-to-date cost information. To illustrate, assume that, based on the contract performance experience up to the point of formula application, the initial cost target is revised to a firm cost target of $800; the contractor has thus reduced estimated cost by $200. He is entitled by application of the profit formula to five per cent of the $200, or $10. This $10, plus the original target profit of $80, totals $90 as the revised (firm) target profit. At this point, the two parties may negotiate either a firm fixed-price incentive contract (if total cost is still substantially uncertain), or a fixed-price contract based on $800 of cost and $90 of profit.

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[4]Office of Assistant Secretary of Defense, op. cit., p. 2.

One of the main deterents to extensive use of the FPIS contract is that, like the redeterminable arrangement, the FPIS contract offers a substantial probability that the initial incentive will be reduced or even completely fail to achieve its desired effect. In other words, since the contract establishes a profit "floor" at the outset, the contractor may be encouraged to keep costs high prior to formula application in order to assure a high firm target cost. In many instances, however, the FPIS contract may be the better solution in situations which would normally require issuance of a letter contract.[5] The letter contract imposes no incentive for contractor control of cost prior to negotiation of a definitive contract.

Cost-Plus-Incentive-Fee Contracts

The cost-plus-incentive-fee contract (CPIF) is a cost reimbursement contract used primarily when there is insufficient historical cost data to establish a realistic firm target cost.[6] Profit is adjusted according to a sharing formula similar to that of the fixed-price incentive contract. The application of the formula determines the amount of fee payable to the contractor, based on the relationship between

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[5] Ibid., p. 6.

[6] Kalikow, op. cit., p. 69.

target cost and final total allowable cost. However, in contrast to the FPIF arrangement, where no profit ceiling or floor is negotiated, the CPIF contract must contain a stated maximum and minimum fee. The maximum may range up to 15 per cent of target cost on research and development contracts and 10 per cent on production contracts.[7] However, ASPR states:[8]

> Whenever this type of contract, with or without the inclusion of performance incentives, is negotiated to provide incentive up to a high maximum fee, the contract also shall provide for a low minimum fee, which may even be a "zero" fee, or, in rare cases, a "negative" fee.

The sharing formula for determining profit under a CPIF contract varies greatly and may depend on the weight or importance attached to cost control as an incentive factor, the degree of confidence the parties express in the target cost, and other similar criteria. The range of cost over which the incentive principle operates is extensive; ASPR states that cost incentives on CPIF contracts "should be negotiated so as to provide an incentive which will be effective over variations in target cost of at least 25 per cent from target."[9] Thus, the probability is reduced

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[7]Office of Assistant Secretary of Defense, op. cit., p. 7.

[8]Department of Defense, op. cit., 3-405:4.

[9]Ibid.

that the incentive provisions will expire at an early point in contract perfromance, thereby creating a cost-plus-fixed-fee situation in which little emphasis may be placed on cost.

The CPIF contract will be the type generally used for future research and development awards, as evidenced by the decline in use of the CPFF arrangement from 38 per cent of total contract dollar value during fiscal year 1962 to a proposed low of 12.3 per cent during fiscal year 1965.[10] The CPIF arrangement will involve not only cost, but schedule and performance incentives as well. Of primary importance is the relative weight assigned each objective. In the development stage of the project, for example, performance might carry a weight of 50 per cent (that is, it will affect the fee reward/penalty by as much as one-half), schedule might be weighted 33 1/3 per cent, and cost 16 2/3 per cent. At a later stage in the procurement cycle, the cost incentive might be assigned a weight of 50 per cent, performance 33 1/3 per cent, and schedule 16 2/3 per cent. Toward the end of the procurement cycle, a fixed-price contract might be negotiated which would have the effect of assigning the cost control incentive a weight of 100 per cent.

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[10] Supra., p. 24.

II. TYPES OF INCENTIVES

Cost Incentives

Of the three basic types of incentives--cost, schedule, and performance--cost has, in the past, received the widest application.[11] It is also the simplest in concept; the contractor's profit increases or decreases as his actual incurred costs fall below or exceed target cost. This sharing arrangement must offer the contractor a real incentive to meet or better cost objectives; rewards must be commensurate with risk assumed while, at the same time, avoiding the situation in which cost is over- or under-emphasized relative to other procurement objectives.

Between this relatively simple incentive concept and the actual writing of cost incentive arrangements, however, are several highly complex questions which must be answered to the satisfaction of both parties. For instance, should incentive objectives differ depending upon whether the contract is a CPIF or a fixed-price incentive? How are target cost and target fee arrived at? Over what range of cost should the incentive operate? How is the sharing arrangement determined? For a discussion of these and other cost incentive problems, the reader is referred to an excerpt

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[11] Office of Assistant Secretary of Defense, op. cit., p. 10.

from the Department of Defense Incentive Contracting Guide, reprinted in Appendix A.

Schedule Incentives

The traditional incentives applied by the government to deliveries have been of a "negative" nature. Primary attention has been focused on legal remedies available if the contractor fails in his attempt to meet the scheduled delivery date. For example, the government may use the threat of termination for default, with the excess costs of reprocurement billed to the defaulting contractor. Also, the contract may contain a "liquidated damages" provision under which the contractor forfeits a certain dollar sum for every unexcused day of delinquency. Both concepts confront the contractor with out-of-pocket costs if he fails to deliver.

On the whole, however, these provisions have had little positive effect, especially on development contracts.[12] Complex and urgent problems tend to lock contractor and government together until a satisfactory product is delivered, on time or not--making the question of "damages" largely academic. Also, a certain degree of flexibility might be desirable, but is not provided for by the above legal methods of schedule control.

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[12] Ibid., p. 21.

The DOD has recently turned to the philosophy of "positive" emphasis for schedule control. Profit or fee will vary with this element as well as with cost and performance. Penalty provisions will continue to be used but a structure of stated rewards embodying schedule incentives will be encountered much more frequently than in the past.

Schedule incentives are involved with problems somewhat different from those of the cost incentive. Should delivery incentives, for example, involve only the final delivery of the end item or should interim objectives be stated? If interim goals are established (called "milestoning"), how should they be weighted relative to each other? For a discussion of these and other problem areas, the reader's attention is directed to the DOD policy on these matters, contained in Appendix B.

Performance Incentives

In the opinion of the DOD, there is perhaps no other procurement policy offering greater potential rewards than the expanded use of the performance incentive in development contracts. In its Incentive Contracting Guide, the DOD states:[13] "Properly conceived and applied, these incentives can do more than any other factor to encourage

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[13] Ibid., p. 30.

maximum technological progress under a single contractual effort."

It is in this area of performance incentives that neither government nor industry has had enough significant experience to indicate, in retrospect, whether a particular performance arrangement was relatively "good" or "poor." However, success in cost and schedule estimation depends on the care and thoroughness with which traditional analytical techniques are applied, and not on the use of any complex statistical system per se. So, too, the writing of equally realistic performance incentives will depend upon the analysis of minutely detailed technical aspects of the procurement. An analysis of the performance incentive incentive arrangement is extracted from the Department of Defense Incentive Contracting Guide, and presented in Appendix C.

Multiple Incentives

The inclusion of two or all three basic incentives in one contract is becoming more prevalent as experience is gained in the various incentive areas. Concurrent with this combining of incentives, however, is the problem of relative weighting of the various incentive parameters.

A properly constructed multiple-incentive contract should serve two basic purposes:[14] It should motivate the

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[14] Ibid., p. 38.

contractor to strive to achieve outstanding results in all three incentive areas and, if it becomes apparent later in the contract performance that outstanding results cannot be achieved in all areas, the incentive structure should compel decisions between cost, schedule, and performance that are in consonance with over-all government procurement objectives.

Realization of the first objective depends largely on the range of effectiveness established for each incentive and the probability of achieving outstanding performance in all incentive areas. Realization of the second purpose depends mainly on the relative weights assigned to each incentive area. Consideration of these weights, along with the range of effectiveness of each incentive, will establish the various break-even points for trade-off decisions between cost, schedule, and performance.

How, then, should the range of incentive effectiveness and relative weighting be determined in a specific contractual situation? For discussion in this area, the reader is referred to Appendix D, concerning problems of multiple incentives.

CHAPTER IV

INCENTIVE CONTRACT MANAGEMENT

I. MANAGERIAL CONTROL OF INCENTIVE CONTRACTS

One of the prime requisites for successful contractor performance under an incentive arrangement is high-quality industrial managerial talent. Under a properly written incentive arrangement the amount of fee earned will depend directly on the contractor's managerial talent, and will be evidenced by lower costs, earlier deliveries, and/or higher product quality.

Business Week cites Martin Company's Titan III project as a benchmark for measuring the skill of management under an incentive arrangement.[1] Martin is to produce, with already tested components, a booster for any type of payload from 5,000 pounds to 20,000 pounds which the Air Force may wish to launch. Top managerial talent of Martin is trying to prove that space vehicle technology no longer is paramount. What is needed, they state, is managerial brainpower; we are in an era in which "runaway technology must be governed by management."

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[1] "Management Tightens Its Aerospace Reins," Business Week, No. 1776 (September 14, 1963), p. 98.

This is not to imply that the incentive contract *per se* will present a great many new or unusual administrative problems or a need for new managerial techniques. Instead, industry must give the same careful thought and attention to CPIF contracts that have too often been reserved for contracts of a fixed-price nature and/or highly competitive commercial ventures.

Formerly, an accounting system may have been considered adequate if it flagged overrun prior to its occurrence; however, with the inclusion of incentive parameters the system must be able to detect cost changes soon enough to permit corrective action. Cost-profit relationships must be provided early enough and with sufficient precision so that trade-off decisions amoung various incentives may be made early enough to be effective.

To achieve this end, a Program Evaluation and Review Technique (PERT) type program has been developed which is able to show a continuous picture of profits throughout the life of a contract.[2] Profits, through the design, procurement, engineering, and fabrication stages, can be monitored as though the profits themselves were pieces of hardware being developed under a PERT-type system.

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[2]William Beller, "Contractor Gets Steady Check on Profits With New PERT-Type System," *Missiles and Rockets*, Vol. 14, No. 2 (January 13, 1964), p. 38.

The advantage of having a running picture of profits the contract (incentive or otherwise) is or is not bringing in cannot be overestimated from the viewpoint of top management. For example, the government contract administrator may interpret a contract specification in broad rather than in the specific terms the contractor had in mind when he signed the contract. If there is not a subsequent "meeting of the minds," the contractor usually loses. However, he may fight harder and with more effect if he has a genuine projection of his profit picture.

In actual practice, Profit/PERT would show at each reporting period the profit picture for the past (up to the present), the present (up to the next reporting cycle), and the projected future. This is no different from conventional PERT reporting, other than that profit is the element being reported rather than "time" or "cost."

The input data required in Profit/PERT are minimal and can be entered in the same manner as is normal PERT/Cost data. In the computer, the actual cost of work and materials charged to the item will be subtracted from the contract price (in the case of a fixed-price contract) or from the contract target (in the case of a CPIF contract).

One of industry's gravest doubts concerning the incentive contract is that government decisions will limit the opportunity to maximize fee. Erle Martin of United Aircraft

Corporation believes that contractor efforts will no doubt be stimulated to meet incentive criteria, but there is no evidence that government is sufficiently convinced of this to relax any administrative cost control.[3]

Despite this concern, it is evident that the government will bear the ultimate cost of the contract and cannot relinquish existing controls merely because of a change in contract type. Thus, such items as subcontractor approval clauses, equipment approval clauses, and change authority will remain essentially the same, at least for the near future. As experience is gained and confidence in the incentive arrangement is increased, some relaxation of controls may be expected. Also, since incentive contracts are far more definitive than the CPFF type, much of the guidance previously given by the government may be unnecessary.

II. MANAGERIAL CONTROL OF SUBCONTRACTS

The Department of Defense Incentive Contracting Guide itself says little concerning subcontract management, leaving much in this area to negotiation. It is an important area, nonetheless, since 40 to 60 per cent of each development program is often performed by subcontractors;[4] the

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[3] "Incentive Contracts May Multiply Controls," Aviation Week, Vol. 79, No. 1 (July 1, 1963), p. 98.

[4] Office of Assistant Secretary of Defense, op. cit., p. 47.

prime contractor with an incentive contract may find that a large portion of his potential fee rests on subcontractor performance. The government, in turn, must rely on the prime contractor's purchasing skill to ensure reasonable price and timely delivery of subcontracted items. Benefits will therefore accrue to both parties if subcontracting arrangements are worked out in advance of contract signing.

As for the type of subcontract to be used, the DOD feels that the prime contractor will benefit by finding some way to motivate the subcontractor to contribute to the over-all incentive program.[5] A real problem may evolve if the subcontract is let on a CPFF basis, since the subcontractor can overshoot his cost and schedule targets with relative impunity, causing possible loss of fee for the prime contractor. However, subcontracting on an incentive basis is not always practical; many subcontracts are too small to justify the extensive negotiation effort involved in establishing an incentive arrangement. Perhaps the solution, the DOD feels, is to continue the use of firm fixed-price contracts except in situations where this type is impractical.

III. MANAGEMENT OF CONTRACT CHANGES

The most effectively negotiated incentive provisions can be seriously disrupted when and if contract changes take

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[5] Ibid.

place. Changes are complex when only price or fee and delivery schedule are at issue; the problem is compounded under the simplest of incentive arrangements. Effects of the changes must be determined not only for target cost and fee, but also for the fee sharing ratio and the range of incentive effectiveness. As far as possible, therefore, CPIF developmental specifications should be stated in terms of performance goals rather than detailed designs.[6] These performance objectives will change far less frequently than will detailed design, and the incidence of major change orders will be greatly reduced.

The normal method of handling a change order is to state the effect of the change in terms of cost and profit; the target cost, target fee, and ceiling price are then adjusted by the amount of the change. The same procedure of target adjustment would be followed for delivery and performance incentives. When multiple incentives are involved in change orders, however, care must be exercised to ascertain that the original balance is retained between or amoung the various incentive provisions. For example, if the cost incentive was originally planned to affect profit by 50 per cent, with schedule and performance incentives each affecting profit by 25 per cent, care must be taken to

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[6] Ibid., p. 48.

ascertain that a mere change order will not upset this balance.

The above procedure does little to promote a contractor-originated cost saving, as the only "reward" would be a reduction in the contract size with a resultant reduction in the contractor's business. One solution to this problem is the inclusion of a contract clause whereby the contractor is given a specific percentage of any saving resulting from contractor-originated changes. Another solution would be to have the contractor share in the saving in the same ratio that he shares in cost savings realized, not by changes, but by increases in efficiency. Thus, if a contractor is operating under an 80-20 share line and saves $1,000 through a contractor-originated change, the new target cost would be lowered by $1,000 but target profit would be increased by $200.

CHAPTER V

INCENTIVE CONTRACTING IN OPERATION

Incentive contracting *per se* does not assure lower prices, more timely deliveries, or higher quality performance. What it does provide, when properly implemented, is a contractual framework which utilizes the profit element as an incentive toward outstanding performance.

I. INCREASE IN VALUE ENGINEERING

In many instances the use of the profit incentive has met with outstanding success in the area of cost reduction. It is one of the prime causal factors in the recent rapid growth of value engineering (defined as the concentration on the elimination of any element in the cost of an item that is not necessary or important). *Newsweek* cites several examples of cost-reduction under incentive contracts due to extensive use of value engineering:[1]

> (i) At General Electric's Missile and Space Division in Philadelphia, engineers have found that by using plastic instead of aluminum in some re-entry vehicle systems, $349,000 a year can be saved.

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[1] "When the Pentagon Saves--That's a Gang of Nickles," *Newsweek*, Vol. LXIII No. 10 (March 9, 1964), p. 63.

(ii) At Seattle, Washington, where Boeing is building the Minuteman ICBM, a supplier suggested substituting a 31-cent blasting cap for a $42 detonator (saving: $163,000 a year).

(iii) At Northrup Corporation's modern glass headquarters in Beverly Hills, Calif., where a huge bulletin board lists new ideas and ticks off savings of $2.3 million in the current fiscal year, technicians discovered they could borrow space suits from a nearby Navy station rather than buy them (saving: $25,000).

Such savings are small when considered individually, but add up quickly as the Northrup experience shows.

By making the contractor a "limited partner" in cost cutting, the incentive arrangement has forced the prime contractor to seek increased economy in his purchases, thus forcing cost-cutting measures upon suppliers. Martin Company's Orlando Division, for example, met with its 110 subcontractors for a conference on cost cutting: Martin executive G. Tom Willey states, "We told them if you want to continue business with us we want a 30 per cent price reduction." Twelve months later Martin found the cost of purchased materials had dropped 42.5 per cent, without damaging the final product.[2]

Furthermore, Martin itself has reduced costs on its Bullpup missile incentive contract by over $2 million--through extensive use of value engineering. Under the incentive provisions, the firm received over $400,000 for reducing the costs.[3]

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[2] Ibid., p. 68.

[3] Ibid.

Other government agencies apart from the DOD are also becoming incentive conscious. The Atomic Energy Commission (AEC) has recently incorporated a cost incentive into a contract with a Florida based firm.[4] The incentive was incorporated into an already existing CPFF contract, and thus is amenable to comparisons before and after incentive inclusion. Comparison of pre-incentive operation (first six months of fiscal year 1963) with post-incentive operation (first six months of fiscal year 1964) revealed outstanding achievement in the cost-cutting area. With product mix running substantially the same, 72 per cent more units of product were produced at a cost decrease of 10 per cent per unit. During this same period total overhead cost rose only five per cent and direct labor increased by only 10 per cent. Performance incentives were not included in the incentive arrangement since exceptionally high product quality was mandatory, and any performance beyond the minimum acceptable level would be superfluous.

II. THE INCENTIVE AS A BARGAINING TOOL

Most contract incentives originate as attempts to control costs, while others owe their existence to the need for early delivery and/or exceptionally high quality performance. An additional, but not as common, reason for incentive

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[4]Interview, Albuquerque Operations Office, Atomic Energy Commission, March 5, 1964.

inclusion is due to its use as a government bargaining tool when confronted with industry demands for higher profits on government contracts. For example, a Southern California firm listed the following as reasons why its profit percentage on an AEC project should be increased:[5]

(i) The parent company had substantial investment in the above firm and would need a higher profit rate in order to earn 10 per cent on investment after taxes--a low rate in the industry.

(ii) Acceptance of the proposed fee levels would result in an actual loss to the company for the expected amount of work, due to necessary business costs which are not reimburseable by the AEC.

(iii) The proposed declining fee schedule was based on the assumption that additional research work could be added with little increase in private investment, key staff, and management effort. This assumption, the company stated, was not correct.

(iv) The company had an outstanding record of performance for the AEC.

(v) The old justification for the "low" fee paid the company--the hopefully profitable future commercial use of the product--was not pertinent to the bulk of the company's work for the AEC.

(vi) The company possessed the understanding that other AEC contractors were being treated more favorably.

Rather than answer the request with a flat "yes" or "no," the AEC offered to negotiate a cost incentive as a bargaining tool.

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[5]Interview, San Francisco Operations Office, Atomic Energy Commission, February 14, 1964.

The cost incentive is based on administrative and service overhead and will remain so until enough experience is gained to allow confident broadening of the incentive base. Costs in the administrative and service areas will be subjected to incentive provisions originally because the AEC is of the opinion that these costs are more susceptible to administrative control by the contractor and review by the Commission than are the functional division burden costs. The planned sharing ratio is as follows:

Costs	Cost Sharing Ratio AEC/Ctr*	Maximum Incentive (Penalty) In Each Range	%
$13,000,000 - $14,000,000	85/15	($150,000)	15%
12,000,000 - 13,000,000	90/10	(100,000)	10
11,000,000 - 12,000,000	95/05	(50,000)	5
TARGET = 11,000,000	-	-	-
10,000,000 - 11,000,000	75/25	250,000	25
9,000,000 - 10,000,000	65/35	350,000	35
8,000,000 - 9,000,000	50/50	500,000	50

Maximum Incentive = $1,100,000
Maximum Penalty = $ 300,000

*Ctr = Contractor

Since the normal fee for this contract is based on assumption by the contractor of a minimum risk for cost overruns, the AEC believes that it is reasonable to establish the overrun penalties at lower rates (initially) than the underrun incentives.

Other matters the AEC is taking into account are:

(i) The contractor should agree to furnish all indirect services required by the Commission

under the contract to avoid disputes which might arise if the Commission imposed new requirements or if the contractor attempted to reduce costs by eliminating services previously furnished which the Commission considered to be necessary.

(ii) Special attention will be given to depreciation, rentals, insurance, taxes, and other fixed costs in the negotiation of the overhead cost target.

(iii) Charges from the parent office, such as General and Administrative expense which are based on the ratio of subsidiary business to total parent business, should be considered for elimination from the arrangement since this allocation is beyond the control of subsidiary management. For example, the subsidiary should not receive an upward fee adjustment if the total parent business should increase relatively more than the AEC contract, resulting in a lower allocation of G and A costs to the subsidiary.

The above incentive arrangement thus illustrates the use of the cost incentive as an effective bargaining tool; the contractor has the opportunity to increase his rate of return through more efficient control of overhead costs. Conversely, of course, his profit percentage can decrease to a level below that wihch the contractor felt inadequate originally.

The National Aeronautics and Space Administration (NASA), another non-DOD agency, has also been incorporating incentives into many of its contracts. Deputy Associate Administrator Walter L. Lingle, states: "It is our policy now to look at every major contract to see whether incentives

can be sensibly included."[6] NASA hopes to discourage overbidding on performance and underbidding on cost, believing that better pre-planning and program definition usually are prerequisite to competing for incentive-type contracts.

As of November, 1963, NASA had 17 active incentive contracts with 13 firms, target prices of which totaled $256.5 million with values ranging from $111,039 to $68 million. An additional $24.3 million in CPFF and fixed-price contracts are being renegotiated to include incentive provisions.[7]

The above examples have all been concerned with cost incentives only; however, many government contracts now also contain extensive performance incentive provisions. The remainder of the chapter is devoted to the illustration of a DOD-Air Force contract containing performance incentive provisions.

III. THE "STL" CONTRACT

Much of industry has given the incentive arrangement enthusiastic support for one key reason: officials of government and industry alike admit that the return on defense contracts could stand a substantial increase. From an

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[6] "Agency Renegotiating to Incentives," Missiles and Rockets, Vol. 13, No. 22 (November 25, 1963), p. 103.

[7] Ibid., p. 106.

average of 6.1 per cent of sales in 1956, the defense industyr's pre-tax profits have fallen to 2.9 per cent--partly because of the shift from long production runs to research and development work.[8]

Many companies are thus offering their own incentive proposals as an attempt to boost profits. The Air Force and DOD, for example, initially offered Space Technology Laboratories (STL) a contract to build 10 nuclear detection satellites, to be launched in pairs, for $14 million with a fixed profit of $1 million.[9] STL offered a counter-proposal which set up performance criteria enabling the company to double its profit or lose it all, depending on the quality of the work. According to an STL official:

> Had we accepted the original contract we would have a profit of somewhat more than seven percent, a very healthy fee. On the incentive deal we stood to make as much as 14.95 per cent--or as little as one-half of one per cent.

The complex financial/performance arrangement began with a 168-hour test of the satellites in the company's space chamber. Successful test completion on the first attempt would earn a bonus of $25,000. There would be no bonus on the second try and failure on the third attempt would result in a $20,000 penalty.

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[8] "When the Pentagon Saves--That's a Gang of Nickles," op. cit., p. 64.

[9] "Satellite Builder Takes Chance, Hits Paydirt," The Denver Post, March 29, 1964, p. 18-A.

From the time the spacecraft arrived at Cape Kennedy until liftoff STL would be penalized $5,000 for every 24-hour delay in launching. If a successful launch was achieved on the first attempt, an incentive payment of $125,000 would result. Second attempt success would result in a payment of $98,000 while third attempt success would yield nothing. A fourth attempt would result in a $98,000 penalty, while a fifth attempt would cost STL $125,000.

As for the time-in-orbit incentive category, two months in orbit would result in no earnings while STL would be penalized $1,600 for each day short of a two-month orbit. For the next two months, neither reward nor penalty would result, while a penny per satellite per mile traveled would be earned during the last two months of incentive operation, amounting to a total possible incentive fee of $100,000. As of March 29, 1964, the first two satellites launched had been in orbit for approximately five months and had thus earned one-half of the time-in-orbit incentive fee.

On the next shot in the five-shot series, success will mean a $60,000 incentive payment and failure will result in a $60,000 penalty. The same figures apply for the fourth and fifth shots, while the third will carry a $20,000 reward and $100,000 penalty. When the $5 million booster cost per launching is considered, the importance of launch success is readily apparent.

CHAPTER VI

EVALUATION OF THE INCENTIVE APPROACH

Industrial management and government differ in their opinion of the incentive approach to contracting, the government's objective being to control and/or reduce costs while the contractor's objective is to increase profits. This chapter is devoted to an examination of each viewpoint and concludes with an over-all evaluation of the incentive approach.

I. THE INDUSTRIAL MANAGEMENT VIEW

New Contract Climate

Defense contractors are keenly aware of the change in contract climate brought about by intensified application of incentive provisions. The following comments are typical:[1]

> How we perform on the contract we've got going will decide whether we have a look at the next one.
>
> It used to be your customer would take you on faith, then hold your hand through the trials, delays, and increased costs; now you're vulnerable for penalty and even cancellation if you muff it.
>
> It's not enough any longer to have had a long associati on with your customer (Army, Navy, Air Force);

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[1] "Management Tightens Its Aerospace Reins," op. cit., p. 96.

you've got to show you're good, economical, and on time.

Many major defense companies are thus attempting to create a new approach to their work. Martin Company's Vice President of the Denver Division states:[2]

(i) Management must create the incentive environment to ensure rapid decision.

(ii) The lines of communication must be shorter and faster; knowledgeable men must be kept close to each other.

(iii) Responsibility for making the right decision at the right time must be delegated all the way through the company.

Those possessing the top management talent at Martin Company are convinced that the incentive contracts with which they are working are a major tool for creating management concentration and discipline. Problems have been kept at a minimum because the problems were identified at the start. Keeping the men responsible for each phase of the project close to each other so that decisions can be reached quickly is another key to good management necessitated by the incentive approach, Martin believes.

Profit Outlook

Industry opinion is divided on the degree of increased profits to expect from incentive-type contracting.[3] The

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[2] Ibid.

[3] William H. Gregory, "Industry Mixed on DOD Profit System," Aviation Week, Vol. 79, No. 10 (September 2, 1963), p. 60.

optimists, though doubting that the maximums allowable will ever be attained, feel there will be significant improvement. The pessimists fear that, despite the good intentions, profit levels will rise little or not at all, or that any increases will be lost in review by the Renegotiation Board.

Administrative policy is the essential ingredient, and industry can only wait for experience to provide the answers. Caution in this respect stems from industry feeling that the existing ASPR that espouses policies favorable to industry sometimes loses its intended benefits in actual application.

Early indications are, however, that DOD's contractor stimulation goals are being achieved.[4] Generally condeded by those with incentive contracting experience is that, at least initially, the system has broken cost-plus lethargy. Industry is particularly impressed by the policy statement issued by the DOD along with the new incentive regulations. Especially lauded is the "realistic" evaluation of profit and the inclusion of risk as deserving of reward. Particular policy statements evoking favorable comment include:[5]

> Profit generally is the basic motive of business enterprise. The government and defense contractors should be concerned with harnessing this motive

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[4] Ibid., p. 61.

[5] Ibid.

> to work for more effective and economical contract performance.
>
> Negotiation of very low profits, the use of historical averages, or the automatic application of a predetermined percentage to the total estimated cost of a product, does not provide the motivation to accomplish such performance.
>
> Furthermore, low average profit rates on defense contracts over-all are detrimental to the public interest. Effective national defense in a free enterprise economy requires that the best industrial capabilities be attracted to defense contracts. These capabilities will be driven away from the defense market if defense contracts are characterized by low profit opportunities.
>
> Consequently, negotiations aimed merely at reducing costs by reducing profits, with no realization of the functioning of profits, cannot be condoned.
>
> For each contract in which profit is negotiated as a separate element of the contract price, the aim of negotiation should be to employ the profit motive so as to impel effective contract performance by which over-all contract costs are economically controlled.

Industry feeling is that the above language seems to take into account the consequences of squeezing profits or "buying into" contracts, a practice that usually results in a cost overrun later.

Erle Martin, Vice President of Research and Development for United Aircraft, views the incentive approach to contracting as a possible means to future relaxation of governmental administrative controls. He states:[6]

> Although federal participation in technological innovation has proven wasteful, it is apparent that

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[6]"Incentive Contracts May Multiply Controls," op. cit., p. 98.

> the basic reason for this has been the assumption on the part of the government of the risk-taking function.
>
> The assumption of this function has in turn reduced the motivation on the part of the contractor to hold down costs. This in turn has forced the government to apply progressively more detailed administrative controls in an effort to control costs, which have in fact increased costs.

Martin proposes that increased risk on the part of the contractor (brought on by incentive application) will tend to lessen governmental administrative control, thus reducing administrative costs. Government assumption of risk would still be required, he states, but it should prevent catastrophic loss to the contractor, not losses caused by poor performance.

One Area of Caution

As evidenced by the above optimistic outlook, industrial management has, as a whole, been quite receptive to the increased usage of incentive contracting provisions. However, an extremely cautious approach is advocated when applying incentives to the funding of research and development contracts.[7] Much of industry believes that too many advanced concepts are being studied to death and dying in the idea stage for lack of aggressive research and development funding. Even after a contract is funded, a contractor

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[7]"Contractors Find Flaws in New Regime," Missiles and Rockets, Vol. 12, No. 12 (March 25, 1963), p. 66.

tends to play safe; with the tightly controlled amount being spent on the contract, he does not dare make a mistake, so he builds a product that is fairly certain of success.

The best situation, one contractor states, is to conduct a reasonable number of non-incentive expeditions into prototypes with a hard-hitting research and development effort.[8] More chances would be taken, and several choices would be produced. Thus, a better, more advanced weapon system would result.

II. THE GOVERNMENTAL VIEW

The DOD is in favor of using the incentive approach to contracting wherever practical, as evidenced by its Incentive Contracting Guide, ASPR, and various policy statements on the subject.[9] However, there is considerable governmental opposition to incentive contracting, emanating from Congress generally and from the House of Representatives Armed Services Committee specifically.

Disadvantages of the Incentive Approach

The leader of those who oppose incentive application has been Representative Carl Vinson (D.-Ga.), Chairman of the House Armed Services Committee (HASC). His contention

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[8] Ibid.

[9] Supra., pp. 59,60.

is that, in the incentive arrangement, "there is only the illusion of a cost saving, which simply indicates that the contract was overpriced" when negotiated.[10]

Evidence of original overpricing and lack of risk is offered by a HASC report which states that of 171 Air Force incentive contracts examined, totaling $6.3 billion, in only one case was the ceiling price exceeded--and then by only $87,000. Of 47 Navy incentive contracts for $2.5 billion, only one contract was overrun and resulted in a penalty of $54,000.[11]

In testimony before the HASC, Courtney Johnson, Assistant Secretary of Army for Logistics, stated that as an alternative to the incentive contract--in the procurement area between CPFF (cost unknown) and fixed-price contracting (cost known)--the Army is using price redeterminable contracts. The Army gives consideration to the contractor's "efficiency, economy, and ingenuity" in the allowance of profits. In fiscal year 1959, 245 Army redeterminable contracts originally priced at $656 million were subsequently priced at $631 million, a reduction of $25 million; profit on the contracts was reduced by $8 million.[12]

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[10]Katherine Johnsen, "House Group Asks Procurement Changes," Aviation Week, Vol. 72, No. 20 (May 16, 1960), p. 135.

[11]"House Calls for Accurate Cost Data," Aviation Week, Vol. 72, No. 25 (June 20, 1960), p. 75.

[12]"House Group Asks Procurement Changes," op. cit.

In further opposition to the incentive approach, Thomas Coggeshall, until recently Chairman of the Renegotiation Board, has stated that the incentive formula operates automatically whenever actual costs are lower than target costs, without reference to the reason.[13] Reasons wholly unrelated to the contractor's efficiency may result in greater profits than could reasonably have been foreseen. Erroneous target cost estimates, unanticipated cost savings due to the impact of additional defense production volume, and lowered market prices of purchased materials are cited as means to higher profit which are not influenced by either the contractor's efficiency or inefficiency.

Coggeshall further states that it is important to recognize that, in the above cases, the contractor will be allowed, at target setting time, some costs which he will never incur under the contract, together with a profit thereon; and then, in the final analysis, he will receive a bonus for not having incurred them. "It can hardly be claimed that the contractor's efficiency--he might even be inefficient--has played any part in his enrichment. He has done nothing more than show a decrease in costs that were overstated in the first place."

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[13] Ibid.

The Government Accounting Office (GAO) has stated that in cases where costs are uncertain and there is the probability of change orders, the GAO would favor the use of the CPFF contract rather than the incentive arrangement. The GAO added, however, that when costs are ascertainable with accuracy, "incentive contracts can be a real benefit both to the government and to the contractor..."[14]

Senate Permanent Investigating Subcommittee calculations have shown that on three incentive-type contracts with Boeing under the Bomarc air defense missile program, the Air Force would have saved approximately $14 million in profits had the contracts been CPFF. The contracts analyzed were:[15]

(i) Production of 78 Bomarc A missiles on which there was a profit of $12 million, or 14.5 per cent, on a total cost of $82.7 million. Boeing had originally proposed a cost plus six per cent fixed fee contract. Taking the highest estimated cost at the time of negotiations--$114 million--the subcommittee staff estimated that at six per cent, Boeing's profit would have been only $6.8 million, or $5.2 million less than the government paid out under the incentive provision.

(ii) Production of 168 Bomarc As on which there was a profit of $14.9 million--$11.9 million basic profit and $3 million incentive profit--on total costs of $112 million. Boeing originally asked for a letter contract with

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[14]Katherine Johnsen, "McClellan Airs Incentive Contract Issue," Aviation Week, Vol. 76, No. 22 (May 28, 1962), p. 36.

[15]Ibid.

postponement of negotiation until cost data was developed. The subcommittee staff estimated a maximum profit, under a cost plus eight per cent fixed fee contract, would have been $11.9 million, or $3 million less than the amount received by Boeing under the incentive contract.

(iii) Production of 116 Bomarc B missiles on which there was a $20.9 million, or 11 per cent, profit. Boeing had proposed a cost plus fixed fee of 6.7 per cent. At this fee, the subcommittee estimated, the profit paid by the Air Force would have been $5.9 million less than actually paid under the incentive contract.

As evidenced by the above stated criticisms, governmental concern over incentive application revolves largely around resultant high profit percentages and profit dollars. Congressional opinion of the incentive approach is well summed up by a House Armed Services Committee statement that the incentive contract is "shrouded in the gravest doubts" in terms of its effectiveness as a contractual instrument.[16]

Advantages of the Incentive Approach

Despite the above objections, many federal personnel are convinced that incentive contracting does offer substantial benefits to the government. In testimony before the HASC, Fred A. Bantz, Undersecretary of Navy, stated that the incentive contract is "vital to the interests of the Navy Department in order to procure complex equipment at the least cost. We feel strongly that, if this type of contract were not available, we would be forced into greater use of

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[16]"Renegotiation Urged as Permanent Law," Aviation Week, Vol. 73, No. 1 (July 4, 1960), p. 38.

redeterminable and cost-type contracts which, in our opinion, are not as effective in controlling costs."[17]

In similar testimony, Assistant Secretary of Defense for Supply and Logistics, Perkins McGuire, told the committee that limiting incentive contract usage would force DOD to enter into more and more CPFF contracts which are "frequently the most costly and inefficient types of contracts."[18] He argues further that incentive experience has demonstrated that it is much more important in dollars to the government to assure that all potential savings be made, with as much as 80 per cent or more of the savings reverting to the government, than it is to discourage any part of such savings simply because they are not demonstrably "earned."

Also, it may be extemely difficult to determine which savings are actually "earned." It would be difficult, for instance, to determine if reduction in procurement costs were attributable to subcontractor efficiency or whether they had been brought about through skillful purchasing by the prime contractor.

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[17] "House Group Asks Procurement Changes," op. cit., p. 126.

[18] Katherine Johnsen, "Defense Approves Bill to Tighten Incentive Contracting Practices," Aviation Week, Vol. 72, No. 23 (June 6, 1960), p. 34.

A study by the Renegotiation Board of the 25 contractors whose total refunds to the government were the highest during the period from 1951 through 1959 revealed that profits on the fixed-price incentive contracts involved averaged 8.8 per cent of sales, while fixed-price profits averaged 18.3 per cent and price redeterminable profits averaged 10.6 per cent.[19] (The implied conclusion that the incentive contracts resulted in less contractor profit is refuted by Thomas Coggeshall, ex-chairman of the Renegotiation Board. He cites the fact that the incentive contractors realized a return of 71.3 per cent on allocated net worth. During the same period, fixed-price and redeterminable contractors realized only 42.6 per cent on the total net worth allocated to government production.)[20]

Review of the above opinions clearly illustrates that government opinion of the incentive approach is divided according to the basis of evaluation; those who favor incentives base their evaluation on over-all price analysis, while those in opposition are extensively concerned with profit analysis.

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[19] "House Group Asks Procurement Changes," op. cit., p. 126.

[20] Ibid.

III. EVALUATION

The incentive approach to contracting will not be evaluated as a separate contracting method per se. The incentive approach originated as an attempt to rectify the defects inherent in other contract types (specifically CPFF) and thus will be evaluated according to the extent to which it remedies these defects.

Schedule and Performance Incentives

Evaluation of the incentive approach will emphasize the cost incentive, as it is the one which has generated the greatest controversy. Schedule and performance incentives have met with little oposition because genuine need must first precede their inclusion; by definition, because the need is genuine, the government is willing to pay a premium for exceptional performance in these areas. Also, the contract is usually written so that the contractor has a fair chance of achieving target; thus, the contractor has been quite amenable to schedule and performance incentives as a means to higher profits through increased managerial efficiency.

Obviously, there is also a genuine need for cost reduction and control. However, when a cost target is underrun and costs are therefore "reduced," the standard Congressional answer is that target underrun merely illustrates

that costs were originally overestimated. Advocates of cost incentive application vigorously contend that there is a genuine cost reduction when targets are bettered. Herein lies the controversy.

Cost Incentives

There is no doubt that cost incentives have had outstanding success in achieving actual costs less than target costs. For example, of the previously cited 218 Air Force and Navy incentive contracts totaling $8.8 billion, only two contracts resulted in overruns, the total of which was only $141,000.[21] This type of performance is looked upon unfavorable by the House Armed Services Committee, which views the above result as evidence of lack of contractor risk and/or original overpricing. Yet the only alternative to the above situation may be one such as that cited by Representative Melvin Price (D.-Ill.) in which 90 of 100 NASA CPFF projects, each originally estimated to cost $1 million or more, resulted in overruns up to a figure in excess of 1,000 per cent.[22] Whether these overruns resulted from low estimates due to attempts to "buy into" the contract or whether they resulted from cost control lethargy or other

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[21] Supra., p. 63.

[22] Supra., pp. 16, 17.

factors is not known. The fact remains that the CPFF contract targets were substantially overrun, while in the incentive arrangements the overruns were negligible.

Both the Renegotiation Board and the House Armed Services Committee are of the opinion that reduction of actual cost below target cost merely indicates original overpricing; the contractor should not be rewarded for eliminating costs which should not have been included initially. Unless the reduction can be conclusively proved as resulting from contractor efficiency and not from overpricing or "windfall gains," the entire benefit should accrue to the government.

This contention, though true in part, is not valid as a whole. The government should encourage all possible cost reductions and not just those which can be clearly and completely demonstrated as resulting from contractor skill, efficiency, or ingenuity. If incentive reward is limited to those reductions for which proof is possible, many other cost reductions might never be made because the contractor would have no incentive to do so. Instead, there might be an incentive not to make them so the contractor could keep his costs high and thus keep both cost and profit high on follow-on contracts. By eliminating incentive rewards for all but provable "efficiency" reductions, the government will pay 100 per cent of what might have resulted in cost savings had over-all cost incentives been included. With the operation

of an 80-20 share agreement, for instance, it is reasonable to assume that the government would benefit by 80 per cent of various cost savings that would never have been saved had the over-all cost incentive not been operating.

Much of the opposition to incentive contracting is based on faulty evaluation procedure; the Senate Permanent Investigating Subcommittee's evaluation of the three previously cited Boeing contracts[23] exemplifies such a procedure. Its calculation that $14 million in profits could have been saved had the contracts been CPFF instead of the incentive-type illustrates excessive concern with profit and too little concern with total price.

In the first Boeing contract cited, for example, there was a profit of $12 million, or 14.5 per cent, on total cost of $82.7 million; base profit was $9.5 million and incentive profit equalled $2.5 million. The originally proposed six per cent fixed fee applied to the highest estimated cost at the time of negotiation--$114 million--would have resulted in a profit of $6.8 million. Thus, the conclusion of the subcommittee is that the government would have saved $5.2 million in profit had a CPFF contract been negotiated rather than the incentive-type. This line of reasoning is valid in itself, but it leads the user to infer

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[23] Supra., pp. 65, 66.

that federal expenditures on the contract would have been reduced by $5.2 million had a CPFF contract been used. This resulting inference is laden with doubt when total expected payout under the two contract types is compared.

Total price to the government under the incentive provision was $87.2 million of cost and $12 million of profit, or $99.2 million. Under the hypothetical CPFF arrangement, using the $114 million of cost and $6.8 million of profit, total price to the government would have been $120.8 million, a difference of a $21.6 million increase over the total pay-out under the incentive contract.

Admittedly, the CPFF approach very likely would not have resulted in costs of $114 million--the high estimate during negotiation stages--and a lower figure may well be more realistic. However, as evidence previously cited clearly illustrates, cost overrun on CPFF contracts has been the rule and not the exception,[24] while cost underrun has been the rule in incentive contracting.[25]

Therefore, since there was cost underrun on the above contract (evidenced by the earning of a $2.5 million incentive fee), it is reasonable to conclude that much, if not all, of the underrun was due to motivation provided by the

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[24] Supra., pp. 16, 17.

[25] Supra., p. 63.

cost incentive. And, if past experience is any indicator of future performance, the hypothetical CPFF contract would likely have resulted in cost overrun. Since target cost on an incentive contract is the same figure as estimated cost for performing the same work under a CPFF contract,[26] analysis should have been directed at the difference between the actual cost incurred under the incentive contract and the expected cost which would have been incurred had a CPFF contract been written.

It would be unreasonable to assume that there would be no difference, since past experience has consistently shown incentive cost target underruns and CPFF cost estimate overruns. Profits under each type should then be added to cost and the total prices to the government compared; it is this total price which should be the government's foremost concern, not profit dollars or profit percentages. Analyses of this type may well lead to conclusions drastically opposed to those offered by the Senate Permanent Investigating Subcommittee.

The contention is also advanced that both the Renegotiation Board and the House Armed Services Committee approach the problem of pricing too much on the basis of ordinary subcontracting of standard items by a broker. By the very

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[26]Office of Assistant Secretary of Defense, op. cit., p. 12.

nature of the industry, contractors engaged in the development of missiles and other complex weapons systems for national defense for a single customer should receive profits substantially in excess of those producing standard items for sale to the general public. Not only are production risks greater with the former, but many expenses essential to doing business are not reimburseable by the government.

Yet the Renegotiation Board has consistently reduced defense industry profits through the process of annual profit review, and has been especially critical of the "high profit" incentive contract. In a study of defense industry profits, the Board has related profit to net worth allocated to production as a means of illustrating excessive profit percentages on incentive-type contracts.[27] When based on sales price, incentive profits averaged 8.8 per cent, while fixed-price and price redeterminable contract profits averaged 18.3 and 10.3 per cent, respectively. When converted to a percentage of net worth allocated to production, incentive profits climbed to 71.3 per cent while fixed-price and price redeterminable profits averaged only 42.6 per cent.

However, it is contended that net worth allocated to production is not an adequate base from which to measure profits in the highly technical defense industry. This

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[27] Supra., p. 68.

contention was supported by a U. S. Tax Court decision in April, 1958, concerning alleged excess profits on government work performed by North American Aviation, Inc. (NAA).[28] Originally ordered by the Renegotiaion Board to refund $20 million of excess profits, NAA appealed the decision to the Tax Court, and "won back" $3.5 million of profits. The refund stemmed from the Tax Court's doubling of NAA's net worth figure--thus cutting the profit percentage in half--to reflect the company's assets in "know how" and to give a more realistic picture of net worth.

In summation, the incentive principle has real merit in controlling and reducing procurement costs to the government. The value of the cost incentive is not significantly reduced by the supposition that many of the "reductions" do not result from contractor efficiency, but are due merely to initial overpricing. Over-all cost has still been reduced relative to estimated cost, and many costs would never be eliminated if there was not an incentive to do so.

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[28] Katherine Johnsen, "North American Must Repay $16.5 Million," Aviation Week, Vol. 77, No. 19 (November 5, 1962), p. 41.

CHAPTER VII

SUMMARY AND CONCLUSIONS

I. SUMMARY

Thr CPFF contract, though laden with doubt as to its efficiency from a cost standpoint, cannot be eliminated entirely. Contracts which border on the "state of the art" development may, of necessity, continue to be written on a CPFF basis since they involve open-end work statements, a massive use of engineering changes, and a desire for reliability which make it difficult to estimate cost very much in advance of performance. Because the costs cannot be estimated with sufficient accuracy, an incentive based on these costs could result in extremely high profit or no profit at all to the contractor--neither of which is a government objective.

The CPFF contract is certainly not without its advantages. Firstly, unfamiliar production problems may introduce risks into plant operation so that nothing short of complete cost reimbursement provides adequate contractor protection. Secondly, there are changing military demands created by advancing military techniques. In defense industries, these changes are important as they may affect the

continuance of any one contract. In the presence of these influences, it is impossible to visualize how private risk assumption could better serve the public interest than the use of CPFF contracting. As a technique for government direction of industry, the CPFF contract is suitable and workable for these special circumstances of defense production. However, in cases in which costs can be estimated with substantial accuracy and in which the items to be procured are specifically defined, the CPFF contract has nothing to recommend it unless government participation in business activities is an accepted goal.

At the other extreme, the fixed-price contract must also be continued. When costs are known to the extent that a fixed-price may be stated, the savings to the government should result from effective negotiation, not from the possibility of a cost decrease. If the probability of a cost decrease exists, a fixed-price contract should not be negotiated initially and a fixed-price-incentive contract should take its place.

It is in the area between the CPFF situation and the fixed-price situation that cost incentives should be applied. When costs can be estimated with more certainty than would warrant a CPFF approach, but less certainty than would allow the negotiation of a fixed-price, the cost incentive can and should be used as a means of ensuring that all potential cost reductions are taken.

Advance agreement on all major contract issues in perhaps more important to the success of the incentive-type contract than to any other type now being practiced. For the government, this means more careful evaluation of potential contractors and a serious endeavor to make solicitations more definitive. Statements of objectives must be clearer than they have been in the past. For the contractor, it means stronger emphasis on realistic and objective preparation of proposals and greater willingness to examine the job in detail. A heavy incidence of contract changes and/or misunderstandings during contract performance will seriously handicap the incentive provisions--as they must continually be revised--and, in addition, will impose a serious administrative burden on both the government and the contractor. Thus the contract must state precisely what is to be required and what steps will be taken to meet requirements. This can be accomplished only if the managerial and technical aspects of the procurement are carefully and completely analyzed in advance. That this type of pre-planning has been done in incentive contracting is evidenced by the low incidence of cost overrun on past contracts.

II. CONCLUSIONS

Incentive contracting offers substantial savings to the government by providing the contractor with a potential

increase in profits as an incentive to reduce costs through extensive use of value engineering and effective cost control. Examples have been cited which illustrate the fact that incentive cost targets are consistently underrun while CPFF cost estimates are consistently overrun. Since the incentive cost target is the same figure that would have been negotiated as the cost estimate for a CPFF contract, the resultant savings in cost are apparent. Admittedly, the profit dollars may be larger under the incentive contract, but it is total price to the government which must be analyzed, not profit dollars alone.

Outlook for Incentive Application

Success with the incentive approach to contracting may well depend on the future policies of the Renegotiation Board. The Board reviews profits of all firms with government billings of at least $1 million per year or who have at least $20 million worth of government contracts outstanding at any one time.

If the contractor must run the risk of having to repay the government any substantial "windfall profits" due to solving problems too "quickly," incentive provisions will obviously lose their planned effect. Firms may pursue a course of action which will protect reasonable profits rather than lead to "windfall gains." This will insure the contractor against claims that original cost or time estimates

were inaccurate, and time saved through breakthroughs can be applied against related work. Under these conditions, it is apparent that the incentive contract can become a deterrent to performance as well as an incentive.

However, Graeme Bannerman, Deputy Assistant Secretary of Defense for Procurement, states that the DOD and the Renegotiation Board have been working closely together for the past year, a fact confirmed by Lawrence Hartwig, present Board Chairman.[1] Bannerman has also stressed that the factors that yield a good profit for a company operating under an incentive contract are the same factors that the Board considers as justification for high profit: high risk taking, good cost control, timely completion, and good hardware performance. "I see no conflict," he states, "with what we are doing and with what the Renegotiation Board is set up to do; in fact, we complement one another." He cautions, however, that by no means has the Board acquiesced to the DOD point of view.

If the contractor is allowed to keep at least a substantial portion of his incentive profits, whether resulting from "windfall gains" or from efficient cost control, the incentive approach may well achieve its objective of high quality product at reasonable cost. Cost reduction in

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[1] William Beller, "Incentives Marked by Profit Formulas," Missiles and Rockets, Vol. 14, No. 3 (January 20, 1964), p. 24.

government procurement can be achieved, but both Congress and the Renegotiation Board must recognize that financial rewards are prime movers of economic activity. Total price comparisons, not profit comparisons, should be the basis upon which to judge procurement cost efficiency.

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APPENDIX

APPENDIX A

COST INCENTIVES

The following section on "Cost Incentives" is taken from the Department of Defense Incentive Contracting Guide.*

PART II. COST INCENTIVES

B. Cost Incentives in Cost Plus Incentive Fee Contracts

A convenient reference for discussion of the cost incentive provisions of any contract is provided by graphic representation of the cost/profit (or fee) relationship. Such a graph is shown in Figure II-1 for a typical CPIF (cost incentive only) contract. A target cost of $100 million and a target fee of $6 million (6 per cent) have been negotiated. The share arrangement (a straight line in this case) offers the contractor an additional fee of $2 million for every $10 million by which his actual costs are below target and, conversely, reduces his fee by $2 million for every $10 million by which these costs exceed target. This arrangement continues to a maximum fee of $12 million, at costs of $70 million, and a minimum fee of zero at costs of $130 million. For costs below $70 million or above $130 million, the fee remains constant at the maximum or minimum. A simple calculation reveals that the slope of the share line represents an 80-20 sharing arrangement applied over a total range of incentive effectiveness of plus or minus $30 million from the target cost of $100 million--i.e., from $70 to $130 million.

The remainder of Part II will focus on the individual elements of the incentive provisions enumerated above; namely, target cost, target fee, minimum and maximum fee,

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*Office of Assistant Secretary of Defense (Installations and Logistics), Department of Defense Incentive Contracting Guide (Boston: Harbridge House, Inc., August, 1962), pp. 10-20.

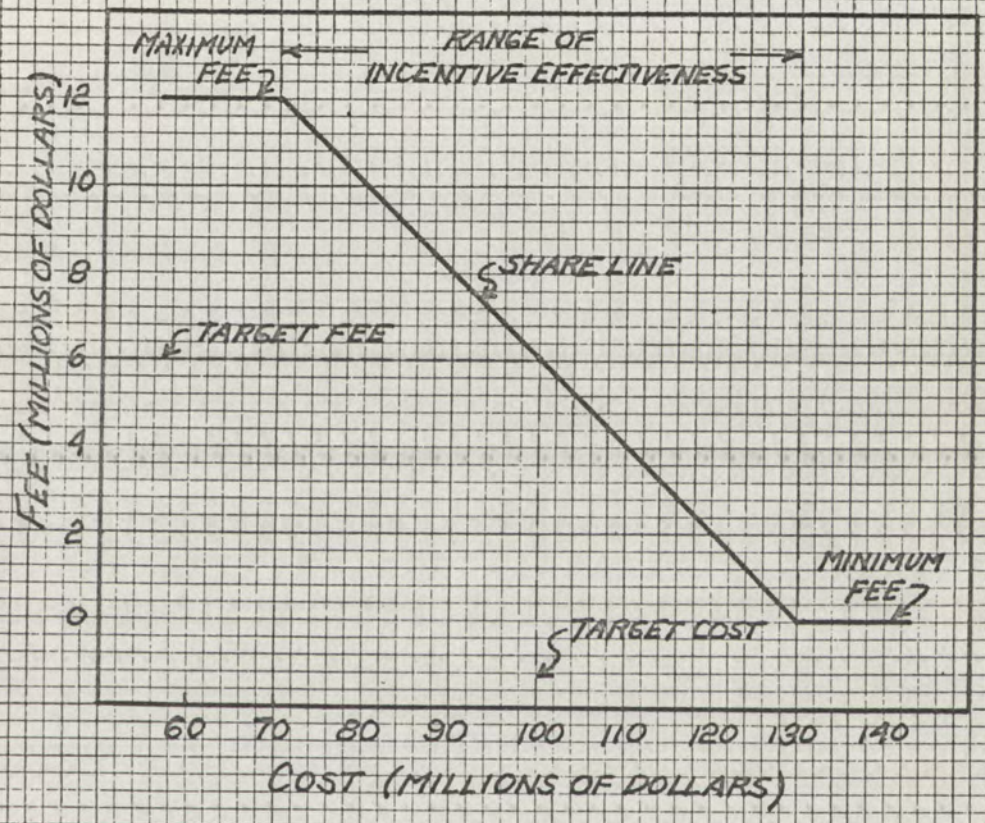

FIGURE II-1

TYPICAL CPIF COST INCENTIVE PROVISIONS

range of incentive effectiveness, and share line. Each of these elements will be the subject of negotiation. Each will be a critical factor in determining whether the overall incentive arrangement meets the criteria outlined in Section A, above.

1. Target Cost

The importance of target cost cannot be overemphasized. While it is perfectly true that, theoretically at least, a target is unnecessary,[1] its negotiation is the indispensable first step in setting an appropriate incentive pattern or, for that matter, in determining whether an incentive arrangement can be used at all. To begin with, establishment of a meaningful target requires careful study and clarification of the technical aspects of the procurement, thus greatly reducing any chance of future misunderstandings or of developing incentive provisions that the two parties may view in different ways. Second, the degree to which target cost approximates one party's initial position will markedly affect the willingness of that party to accept correspondingly stiff incentive provisions. (For example, a contractor who enjoys a favorable bargaining position might seek to force agreement at a high target cost. The government, in turn, might react by insisting on relatively low maximum and minimum fees and more conservative provisions for cost incentive rewards. Or, at the extreme, the government might refuse to write any incentive arrangement and seek, instead, a CPFF contract.) Finally, the very process of negotiating a target cost will condition the degree of confidence which each party has in the resulting figure--i.e., their conclusions regarding the possible extremes of cost above and below target that may actually occur during performance. As will be pointed out later, such an appraisal is essential to fixing the range of costs over which the cost incentive provisions will be applied. It can be seen, therefore,

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[1]Proponents of dispensing with target cost argue that once a minimum and maximum fee and a sharing arrangement have been negotiated, target cost--and target fee--become meaningless quantities. As a practical matter, however, the negotiation of these elements is extremely difficult without the reference point afforded by target cost. This will be discussed in more detail below. It should also be noted that, apart from the considerations enumerated in the text, negotiation of a target cost is required by ASPR 3-405.4 and that statutory and administrative limitations of fee are stated as a percentage of target cost.

that target cost is the focal point from which all other elements of the incentive arrangement will be developed.

At what level, then, should this target be set? Should it be tight or relatively loose? Should it bear any particular relation to the target cost that might be negotiated for the same procurement on a CPFF basis, or to the estimated cost for the same procurement on a fixed price basis? These are hard questions to answer. In general, it may be stated, however, that target cost should represent the best, mutually determined estimate of what allowable costs will actually be when performance is complete. Or, stated another way, target cost should represent that figure at which there is equal probability of either a cost underrun or overrun. These, of course, are the same criteria used for establishing the estimated cost of a CPFF contract and it follows that the CPIF target cost should be the same as the estimated cost for performing the work under a CPFF arrangement.[1] It goes without saying that achieving target costs that meet these criteria is not an easy task. However, with the development and use of such techniques as PERT--and its extension, PERT/Cost--this task is becoming increasingly manageable even on large development projects. In addition, the record itself indicates that, on an overall basis, government and industry are having notable success in negotiating incentive targets that do represent a 50-50 probability of underrun or overrun. It should be feasible, then, in almost every case, to set a target cost that meets the criteria set forth above provided that (i) both parties are genuinely seeking a realistic target and (ii) adequate time is taken during negotiations to analyze the task completely and to apply available estimating techniques with as much precision as possible.

2. Target Fee

The establishment of a target fee for developmental work represents one of the most complex, and certainly one of the most controversial, aspects of the contractual relationship between the government and defense industry. ASPR 3-808 lists the factors to be considered in determining fee or profit for both fixed price and cost reimbursement contracts: effect of competition, degree of risk, nature

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[1]This assumes that the CPIF target cost and the CPFF estimated cost represent the same delivery and equipment performance requirements.

of the work to be performed, extent of government assistance, extent of the contractor's investment, character of the contractor's business, contractor's performance, subcontracting, and unrealistic estimates. These factors, however, are phrased in fairly general terms and no explicit guidance is provided for their application to CPIF contracts.[1] Therefore, since government and industry have had relatively little experience in setting CPIF target fees, and a great deal of experience in negotiating CPFF fees, it may be asked whether target fee under a CPIF contract should be any different from the fixed fee that would be established a CPFF contract awarded at the same target cost. Obviously, under a CPIF arrangement, the contractor has assumed some additional risk; namely, the risk that his fee will actually be less than the target fee. However, since this additional risk is offset by the opportunity to earn more than target fee, it is anticipated that CPIF target fees will be very close to CPFF fixed fees.

3. Maximum and Minimum Fee

DOD's fundamental objective in establishing maximum and minimum fee levels is to create a rewards and penalty structure that will provide the contractor with a genuine incentive to control costs. This involves the consideration of the general area of government policy regarding fee levels and an analysis of the individual firm with which the contract is being negotiated.

The maximum fee that the government may offer is, of course, limited by statute to 15 per cent of the estimated cost for research or development work, six per cent of the estimated cost of the project for architectural or engineering services related to public works, and 10 per cent of the estimated cost for other contracts. There is no such limitation on the minimum fee. In fact, ASPR 3-405.5 states that that when "a high maximum (is negotiated) the contract also shall provide for a low minimum fee, which may be a 'zero' fee or, in rare cases, a 'negative' fee." Thus, as far as statutory control is concerned, there is considerable leeway for offering substantial penalties and rewards.

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[1]An extensive independent study is currently being made of DOD profit and fee policy. Scheduled for completion in the near future, this study should provide more definitive official guidance regarding profit and fee--on both incentive and other contracts--than is presently set forth in ASPR 3-808.

Until recently, however, the government was reluctant to make full use of the available spread between maximum and minimum fees. Administrative limits established within the military departments restricted maximum fees below the statutory levels, and in practice, individual CPIF contracts were generally written with differences of only a few percentage points between maximum and minimum fees. Under these circumstances, it was certainly questionable whether or not an effective incentive was being provided.

Recently, DOD has recognized the weakness of this traditionally conservative approach to setting maximum and minimum fees. ASPR 3-808.5 now states that "the existence of the adminimtrative limitation of 10 per cent for research and development work should not prevent the negotiation of fees, either fixed or incentive, up to the level of the statutory limitation of 15 per cent in the appropriate circumstances." This statement, when read in conjunction with ASPR 3-405.4 (see partial quote above) indicates that the government is now quite amenable to negotiating high maximum fees in return for the contractor's willingness to accept low minimums. This policy has been implemented recently in several major contracts which have had a spread of between zero and 13 to 14 per cent.

In determining the appropriate maximum and minimum fee levels to be used with an individual contract, it is necessary to examine the nature of (i) the work, (ii) the industry concerned, and (iii) the business conditions in the contractor's plant. The first two factors will normally have been given considerable attention during the process of setting target fee. In most cases, the same conclusions that led to establishment of a high or low target fee will lead to establishment, rewpectively, of a wide or narrow spread between minimum and maximum fee. Thus, for example, in industries where consideration of return on investment leads to target fees of, say, foru per cent, a minimum fee of two per cent, and a maximum fee of six per cent might offer a very substantial incentive (in this example, plus or minus 50 per cent when related to target fee). On the other hand, if target fee is set at, say, nine per cent,

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[1]It is in the presence of low target fee that the question of negative minimum fee is likely to arise. A contractor, wishing to increase the incentive stakes over

a much larger spread might be required--4.5 to 13.5 per cent, for example--in order to provide an equally attractive incentive arrangement.

Considerations with regard to the third factor, individual business conditions, are more subtle but, nevertheless, crucial to the problem of establishing an arrangement that actually does provide an incentive to control costs. Basically, the problem arises when the potential contractor will be operating at less than 100 per cent of capacity during performance of the incentive contract. In this situation, if the contribution to fixed overhead for every dollar of cost overrun is greater than the amount by which fee is reduced, the contractor will be strongly motivated to maximum rather than minimize his costs. Obviously, situations of this kind can be avoided only through astute and skillful negotiation of maximum and minimum fees and by a desire on the part of both parties to incorporate meaningful incentives into the contract.

A final question regarding maximum/minimum fee setting is whether or not the two figures should be equidistant above and below target fee. Certainly, there is nothing which says they must be, and it is reasonable to conclude that situations will arise where it will be appropriate to skew the spread between maximum and minimum fee either above or below target. For instance, when the contractor has accepted a tight target cost or a relatively low target fee, he may be justified in demanding that his concessions in these areas be partially offset by setting maximum fee

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a target fee of four per cent to a maximum of 10 per cent, for instance, may logically be confronted with a counter-demand that he also accept a minimum fee of, say, minus two per cent. If a low target fee is, in fact, reasonable for a given industry, a relative high target fee, if realized, would probably be considered unreasonable for negotiation purposes. It is doubtful, therefore, that the contractor would be particularly anxious to set such a high maximum fee or to accept the accompanying risk of a very low or negative minimum fee since the realization of negative fee is quite possible but retention of the high maximum fee is unlikely. Nevertheless, CPIF contracts with negative fee provisions are in existence.

further from target fee and minimum fee closer to target. Naturally, if the government believes that target cost is loose and/or target fee relatively high, the maximum and minimum fees may be adjusted in the opposite direction. Extreme skewing above or below target fee will approach an "awards only" or "penalties only" situation.

4.. Range of Incentive Effectiveness

It has become almost axiomatic in DOD thinking that cost incentive provisions in CPIF contracts should be effective over the entire range of deviations from target cost which may be expected. In other words, if the parties agree that costs may, in the course of performing the work as anticipated, deviate from target by plus or minus 40 per cent, then the incentives should be applied over this entire spread of from 60 to 140 per cent of target. In support of this theory, ASPR 3-405.4 states that on CPIF contracts cost incentive provisions "should be negotiated so as to provide an incentive which will be effective over variations in cost of at least 25 per cent from target." Quite obviously, the point of this thinking is to reduce the probability that the incentive provisions will "run out" at an early point in contract performance, thereby creating a CPFF situation in which little or no emphasis will be placed on cost control.

Establishing the limits of possible costs is an extremely difficult problem. In essence, the contractor and the government must reach agreement concerning the accuracy of the target cost. It has already been concluded that target cost--i.e., the cost that "should be" incurred--will represent, at best, a carefully considered estimate; conclusions regarding its accuracy can be no more than similar, less accurate estimates. Consideration of several factors, however, will provide guidelines.

(i) the complexity and size of the job,

(ii) the number and relative importance of breakthroughs that are required,

(iii) the degree to which the proposed development work has been preceded by research and/or earlier development phases,

(iv) the amount of experience that either the government or the contractor has had in estimating target costs on similar work and the after-the-fact accuracy of such estimating,

(v) the initial negotiating position of the parties regarding target cost (if these positions were relatively far apart, neither party is likely to have much confidence in the target cost finally agreed on). and

(vi) the amount of time available to both parties for estimation and negotiation.

As with maximum/minimum fee it may be asked, should the range of incentive effectiveness be equally distributed above and below target cost? It is reasonable to conclude that as confidence in target cost decreases, the tendency will be to skew the range of incentive effectiveness toward the overrun side. Thus, in a situation where the target cost is believed sufficiently accurate to preclude an overrun greater than plus 25 per cent, it may be quite logical to conclude that a minus 25 per cent underrun is the greatest possible. In this case, a range of plus or minus 25 per cent of target cost would be set. On the other hand, situations may arise in which the target may still represent the fifty-fifty probability of under- or overrun, but in which there is some likelihood of an overrun as great as 100 per cent. Since an underrun of even close to 100 per cent is impossible, the range of effectiveness might be set, for example, at minus 30 per cent to plus 100 per cent of target cost. Skewing may also occur if the target cost does not represent for both parties the best estimate of what costs should be. Thus, if target cost is considered to be tight, perhaps the range of incentive effectiveness should cover a greater amount of overrun than of underrun. The reverse, of course, would be true for a loose target cost.

5. Sharing Line

It is interesting to note that, once the first four elements discussed above have been negotiated, the sharing line (or lines) has already been set.[1] This may be seen by referring to Figures II-2 through II-5. Figure II-2 shows the simplest situation, in which the range of incentive effectiveness is distributed equally above and below target

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[1]This assumes a simple straight-line sharing arrangement or a broken straight-line arrangement. Other, more complex lines will be discussed below.

FIGURE II-2

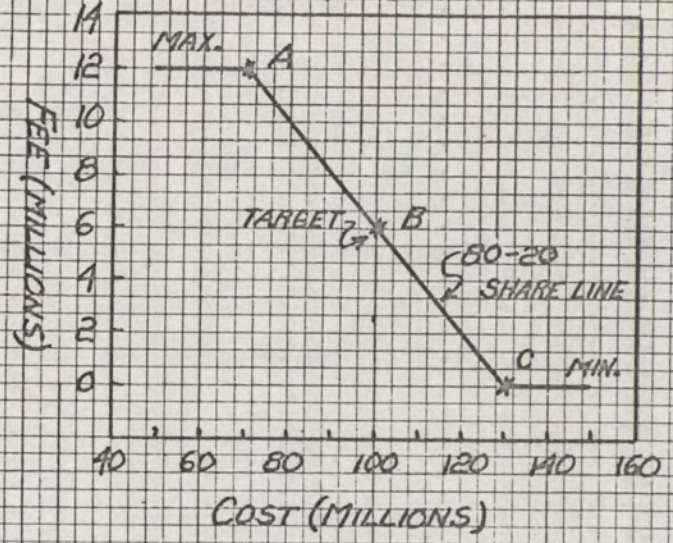
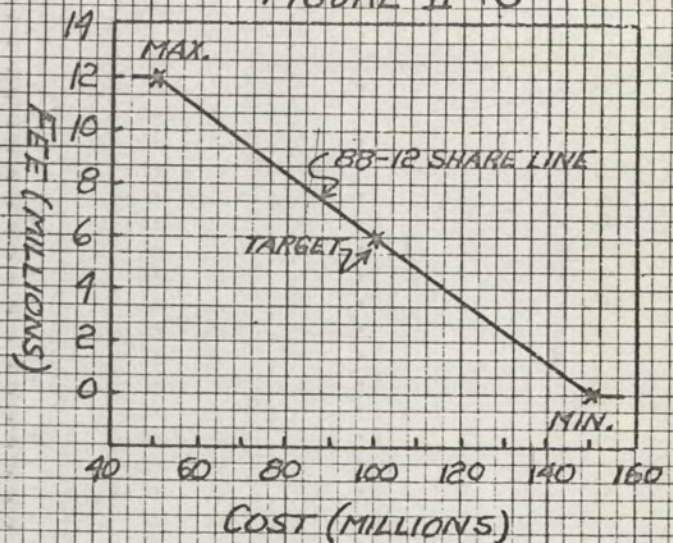


FIGURE II-3



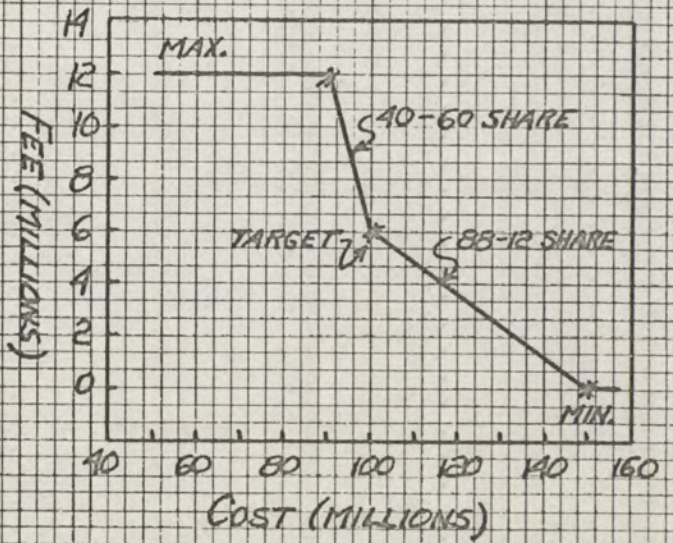


FIGURE II-4

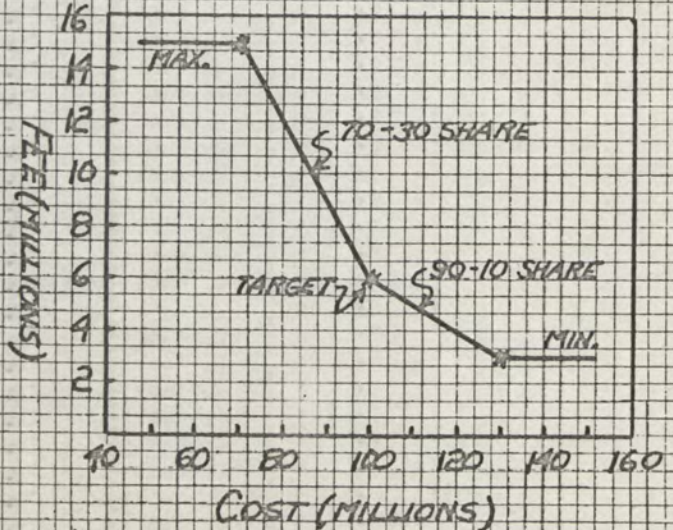


FIGURE II-5

cost and maximum and minimum fee are set at corresponding amounts above and below target fee. Only one straight line can be drawn from point A to point C and still pass through point B--in this example an 80-20 share line. In Figure II-3, the same conditions exist except that the degree of confidence in target cost has decreased from plus or minus 30 per cent to ;ous or minus 50 per cent. Note that the share line--still a single straight line--has changed to 88-12, rather than the 80-20 shown in Figure II-2. Figure II-4 illustrates a situation in which the range of incentive effectiveness has been skewed to the right of target cost. (Maximum and minimum fee are still set at equal amounts above and below target fee.) Here the sharing line becomes a broken straight line with a 40-60 sharing formula to the left of target cost and an 88-12 formula to the right. Finally, in Figure II-5 the range of incentive effectiveness has been returned to the conditions of Figure II-2, but the maximum/minimum fee range has been skewed above target fee. Again, the share formula becomes a broken straight line with a 70-30 slope to the left or target cost, and a 90-10 slope to the right of target.

It may now be asked whether or not it is reasonable to predetermine the share lines in this fashion by first negotiating target cost, target fee, minimum/maximum fee, and the range of incentive effectiveness. Unquestionably, the single, most important determinant of the slope, or slopes, of the share line should be the degree of risk assumed by the contractor. The greater the risk, the greater the rewards he will demand for superior performance, and the greater protection he will demand for failures to meet or better target cost. Now, if reference is made to the discussions on minimum and maximum fee and range of incentive effectiveness, it can be seen that the determination of these factors is, to a very great extent, a matter of risk evaluation. Thus--refering to Figure II-3--the implication of less confidence in target cost (and hence a greater range of incentive effectiveness) is that there is a much greater probability of substantial overruns or underruns. Under these circumstances, the contractor will be led to seek greater overrun protection, and the government to offer less reward for a given amount of underrun. Both these attitudes dictate use of a shallower share line. Comparison of Figure II-3 with Figure II-2 shows that, in fact, the slope of the share line has reacted precisely as desired by both parties in a situation where confidence in target cost has decreased.

Comparison of Figures II-4 and II-5 with Figure II-2 will also show that, as the conditions controlling the determination of the share line have changed, the slopes have again reacted exactly as both sides would want them to. For instance, Figure II-4 might logically result from the contractor's acceptance of a tight target cost. He would reasonably conclude (i) that there is more likelihood of a large overrun than of an underrun and (ii) that the maximum possible overrun may be expected to be greater than the maximum possible underrun. As a result, both he and the government would normally be amenable to greater rewards and less severe penalties. Such a pattern is in fact shown by the share lines in Figure II-4. Analysis of Figure II-5 will lead to the same favorable conclusions concerning the logic of the resulting share lines.

Up to this point, the discussion of sharing lines has been limited to single straight lines or, at most, two straight lines. One other sharing arrangement in fairly common use is illustrated in Figure II-6. A relatively shallow slope is used close to target cost and a steeper slope at costs farther from target. An arrangement of this type is appropriate where small deviations from target are unimportant, but substantial overruns are to be avoided and substantial underruns are particularly desirable. In appropriate circumstances, the shallow slope near target cost may be a horizontal "plateau"--i.e., a 100-0 share line. It should be noted that this arrangement, too, must be applied within the limits established by target cost and fee, maximum/minimum fee, and range of incentive effectiveness.

C. Cost Incentives in Fixed Price Incentive Contracts

As with the discussion of CPIF contracts, it will be convenient to establish a graphic reference for discussion of cost incentives under the fixed price incentive form. This has been done in Figure II-7. Comparison of this plot with Figure II-1 shows that the FPI cost arrangement, like the CPIF, requires negotiation of a target cost, a target profit (fee), and a share line. Unlike the CPIF contract, however, neither a maximum nor minimum profit need be established. Instead there is a ceiling price representing the maximum amount that the government will pay for performance of the contract work. Theoretically, profit can range from a negative amount (if final negotiated actual costs exceed the ceiling price) to a zero profit (if these costs are equal to the ceiling price) to <u>any</u> positive

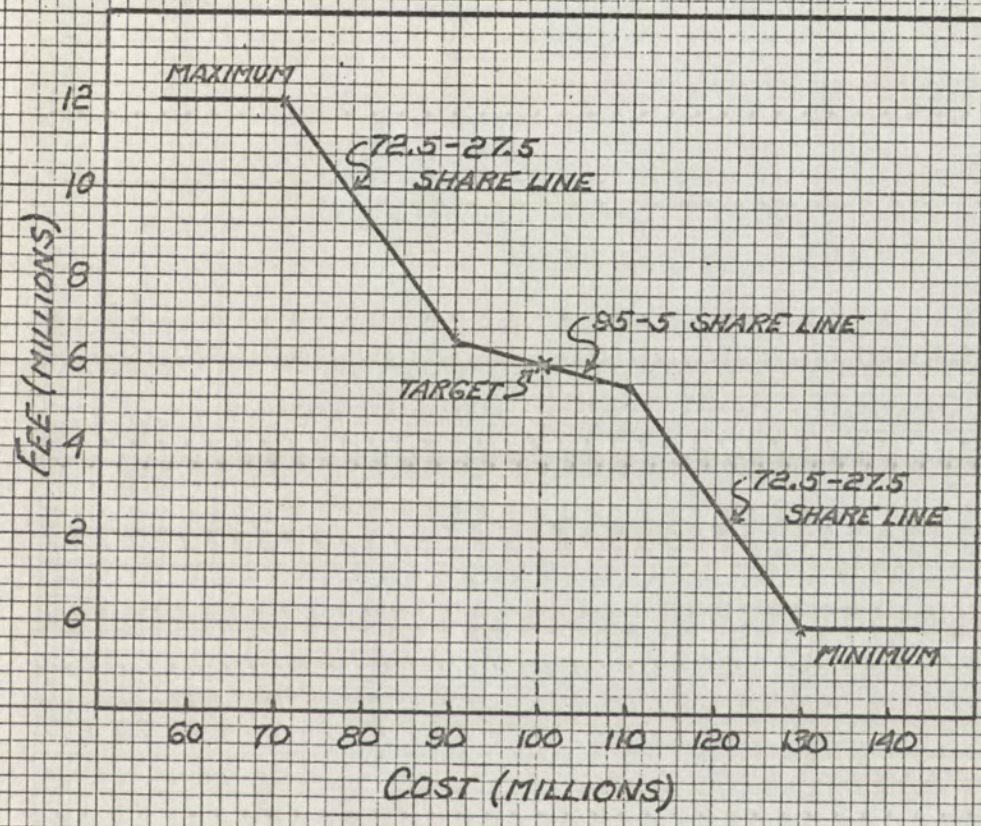

MAXIMUM
72.5-27.5 SHARE LINE
95-5 SHARE LINE
TARGET
72.5-27.5 SHARE LINE
MINIMUM
FEE (MILLIONS)
12
10
8
6
4
2
0
60
70
80
90
100
110
120
130
140
COST (MILLIONS)

FIGURE II-6

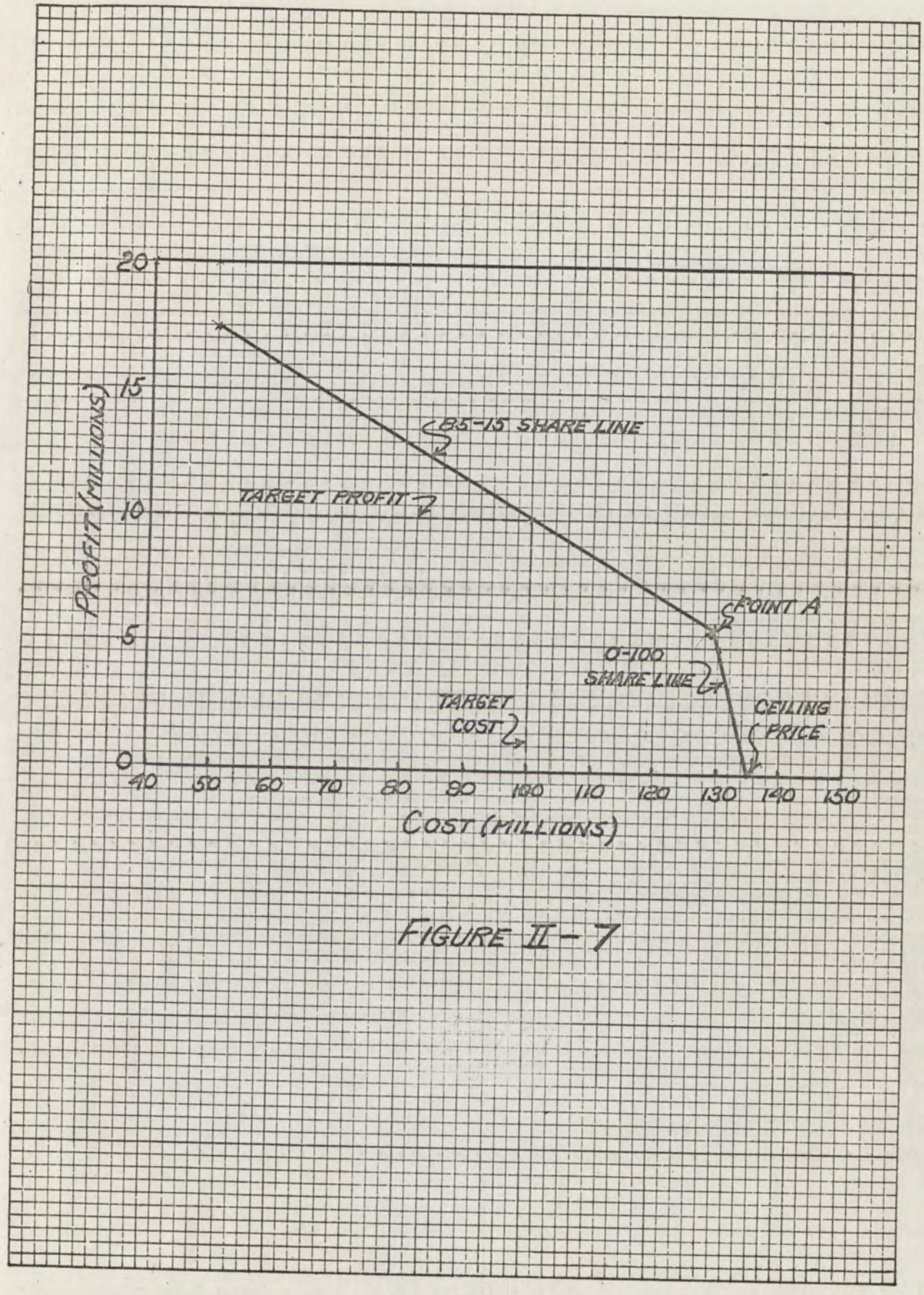

20
15
10
5
0
PROFIT (MILLIONS)
85-15 SHARE LINE
TARGET PROFIT
POINT A
0-100
SHARE LINE
TARGET
COST
CEILING
PRICE
40
50
60
70
80
90
100
110
120
130
140
150
COST (MILLIONS)

FIGURE II-7

amount on the share line (if final negotiated actual costs are below the ceiling price). It should be noted that the result of setting a ceiling price is to create a level of cost--shown by point A in the figure--above which the contract operates as a firm fixed price type. In other words, at any level of cost above point A, the sharing formula is on a 0-100 basis.

These differences between the two contract types--CPIF and FPI--reflect the varying circumstances under which each should be used. Whereas the CPIF type is applicable to situations where confidence in cost estimates is low, ASPR 3-404(c) states that FPI contracts shall not be used where "cost or pricing information adequate for firm targets is not available at the time of initial contract negotiation..." The implication here is that the confidence in FPI cost estimates will be much higher than for the CPIF contract, where confidence limits in excess of plus or minus 25 per cent are expected. In other words, both parties should conclude that there is little or no probability of wide deviation from a well negotiated FPI target cost. As a result, the government is willing to accept the risk inherent in removing any profit ceiling, and the contractor, in turn, is amenable to establishment of a ceiling price. The FPI contract, however, is not to be used when confidence in target cost is sufficient to permit negotiation of a firm fixed price contract that is acceptable to both parties.

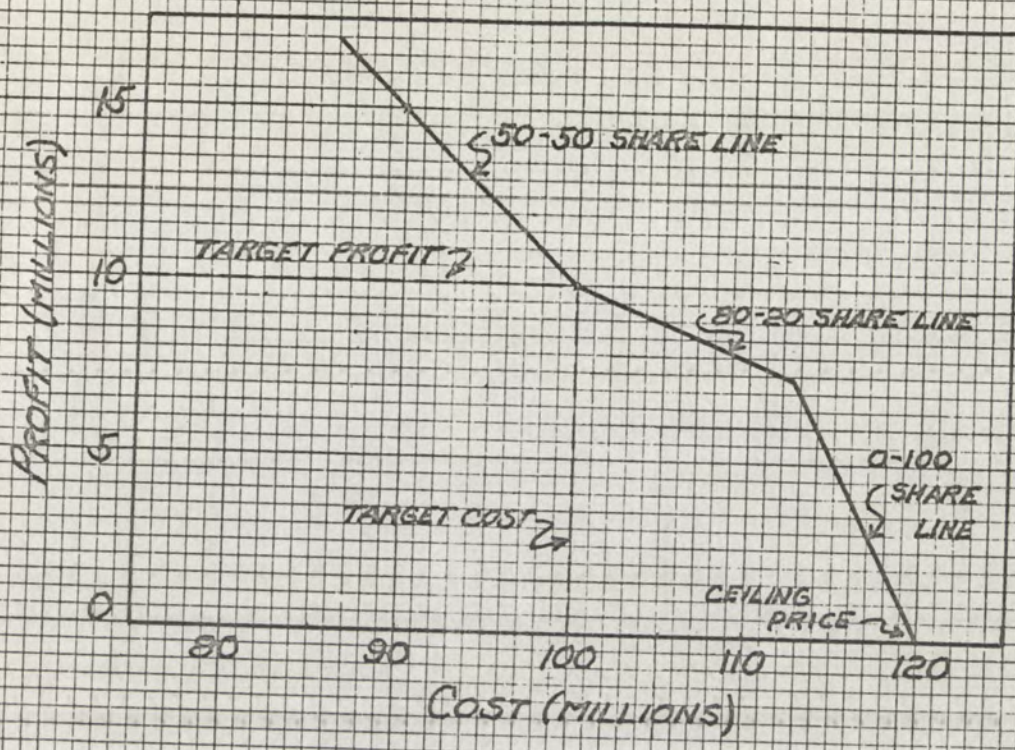
Turning to the problem of setting target cost and target profit, the factors to be considered and the results desired are almost identical to those discussed in relation to target cost and target fee in the CPIF situation. Target cost should represent the best mutual estimate of what the cost "should be"--i.e., that cost for which there is equal probability of underruns and overruns. Target profit will be based on the factors enumerated in ASPR 3-808, along with other considerations such as precedent, return on investment, and bargaining strength. Naturally, the target profit will be affected by the increased risk to the contractor inherent in the FPI contract as compared to the CPIF. Therefore, for a given procurement at a given target cost, a higher target profit would be expected under an FPI contract than under a CPIF form. In actual practice, however, this expectation may be somewhat offset by other considerations, notably bargaining position and the fact that development work--on which the CPIF form would normally be used--usually carries greater risk than the production jobs do.

Once target cost and target profit have been established, the remaining elements to be set are ceiling price and the sharing arrangement. The attitude that each party assumes toward these two parameters and the final agreement reached will be almost totally a question of risk evaluation. And, as was the case in the CPIF situation, this evaluation will rest on (i) an appraisal of the risk inherent in the procurement itself and (ii) any additions or reductions to this inherent risk resulting from the final amount at which target cost has been set. Thus, the same factors that produced shallow or steep share lines in the CPIF contract will operate in the same way in the FPI situation. Furthermore, when high risk results in shallow share lines, it may also be expected to produce a relatively high ceiling price. Conversely, low risk will result in a ceiling quite close to total target price. In general, ceiling prices tend to fall within 105 to 125 per cent of target price, although there is no specific limitation on these figures. When it appears that a lower or higher ceiling is appropriate, consideration should probably be given to changing the contract types to a firm fixed price or a CPIF, respectively.

Share line slopes for FPI contracts have traditionally ranged from 75-25 to 90-10. Again there is no limitation on these figures; current DOD policy is to negotiate higher sharing arrangements when there is evidence of close pricing but a realistic firm fixed price is not obtainable. It is vital, of course, that the share arrangement selected provide the contractor with a genuine incentive to control costs. This, in turn, requires the same careful evaluation of industry characteristics and levels of plant capacity that were discussed in conjunction with CPIF cost incentives.

Straight line cost sharing arrangements are by no means the only type available. Three possible variations are shown in Figures II-8 through II-10 and may be used to advantage in the proper circumstances. The simplest variation (Figure II-8) is a broken straight line, with the two segments of the line intersecting at the point of target cost/target profit. In this case a 50-50 slope is shown to the left of target cost, and an 80-20 slope to the right. Such an arrangement might follow negotiation of what both parties consider a very tight target cost. As a result, the contractor has been given a greater reward for underruns and less severe penalties for overruns. In the case of an unrealistically high target cost, the pattern might be reversed. Figure II-9 illustrates a pattern used

FIGURE II-8



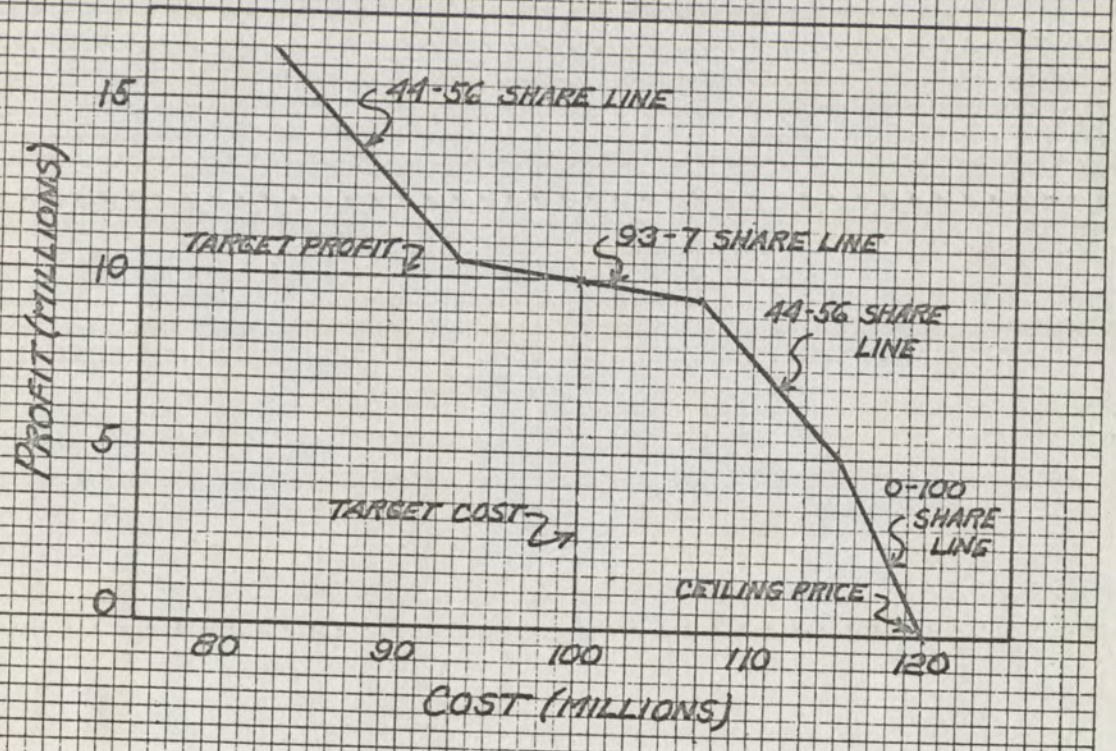


FIGURE II-9

when either (i) small deviations from target are likely to occur whether or not effective control is excercised and/or (ii) these small deviations are relatively unimportant and it is desired to emphasize the achievement of large savings and the avoidance of substantial overruns. Consequently, a shallow 93-7 slope has been used close to target, and a much steeper 44-56 slope at cost levels farther away from target.[1] In Figure II-10, the contractor's share in underruns has been set at 67-33 over the range from $100 million (target cost) to $85 million. Below $85 million, the share line slope has decreased to 93-7, reflecting the government's desire to protect itself against extreme underruns while still avoiding establishment of a ceiling profit. The figure illustrates only three possible alternatives to the straight line; almost any variation may be used if it fits the particular situation and is satisfactory to both parties. It is imperative, however, that the sharing structure be written so as to preclude payment of high profits for cost results which reflect estimating uncertainties rather than contractor proficiency.

Before ending this discussion of fixed price incentive contracts, cost incentives should be mentioned as they are used in the fixed price incentive, successive target type contract. The basic operation of this contract form has been discussed in Part I, above, and will not be restated here. In essence, the initial negotiation (which requires setting initial target cost, initial target profit, price ceiling, the formula for fixing firm target profit, a ceiling and floor for firm target profit, and a production point for applying the formula) involves a combination of the problems present in negotiation of FPI and CPIF contracts. In general, the confidence in target cost, and hence the willingness to accept incentive risks, will be midway between the FPI and the CPIF situation. It is particularly important in initial negotiations that a <u>real</u> cost incentive--as defined above--be incorporated in the contract. Otherwise, the contractor will be encouraged to keep costs high during early performance, thereby ensuring establishment of a higher total price covering the later stages of performance. At the point of final negotiation, the problems become identical to the FPI situation, if, in fact, an FPI rather than an FFP arrangement is to cover the runout portion of the contract.

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[1] As with CPIF provisions discussed above, the shallow slope near target, where appropriate, could be a 100-0 plateau.

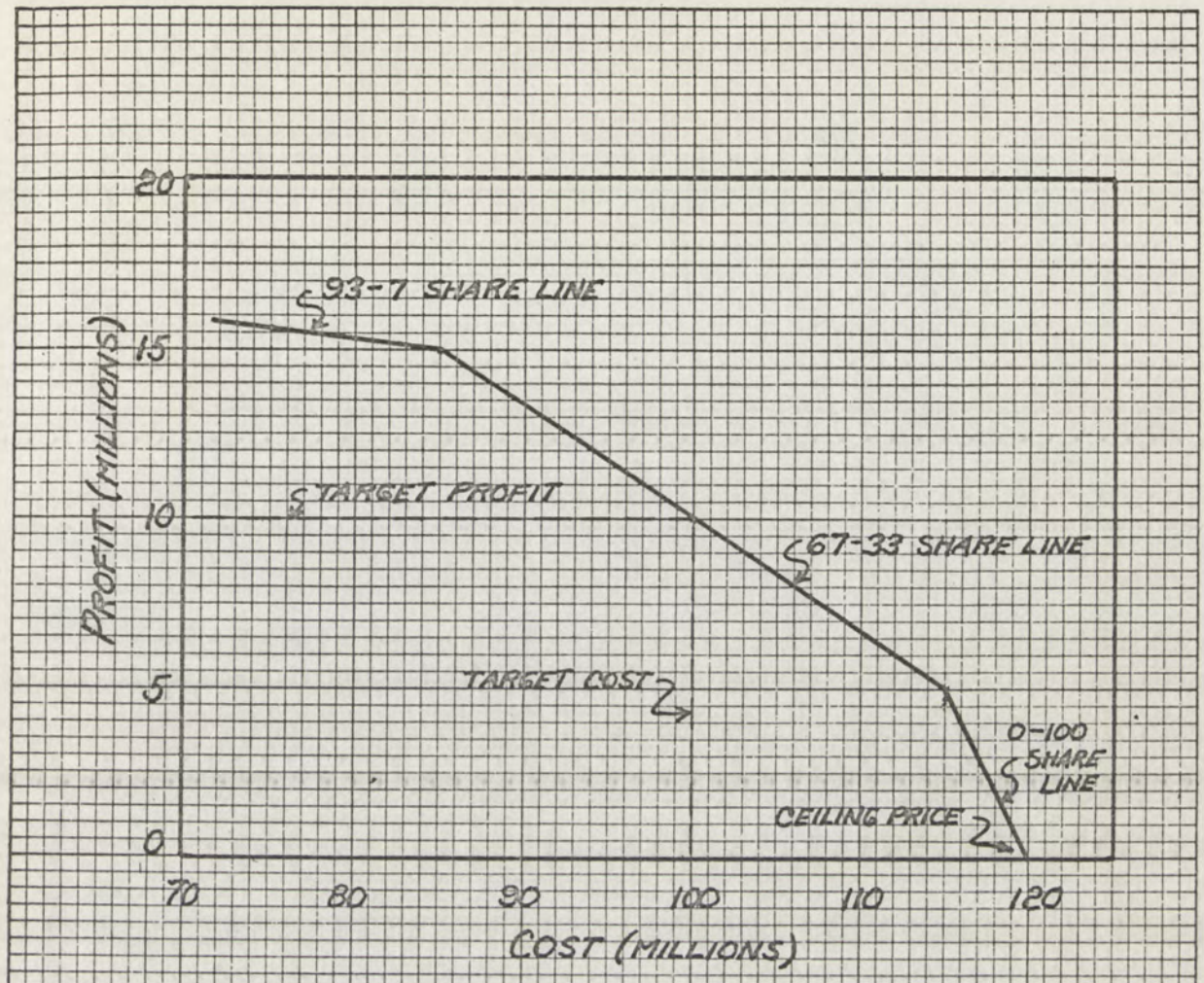
20
15
10
5
0
PROFIT (MILLIONS)
93-7 SHARE LINE
TARGET PROFIT
67-33 SHARE LINE
TARGET COST
0-100 SHARE LINE
CEILING PRICE
70
80
90
100
110
120
COST (MILLIONS)

FIGURE II-10

APPENDIX B

SCHEDULE INCENTIVES

The following section on "Schedule Incentives" is taken from the Department of Defense Incentive Contracting Guide.*

PART III. SCHEDULE INCENTIVES

B. Arguments For and Against Milestoning

To those who favor it, a sequential-goal approach guarantees that the schedule incentive "will work every step of the way." The incentive plan will thus include all the members of the contractor's team, all the managerial and technical skills needed at each stage of the contract--from design to engineering to shop work of varying kinds. Every contractor employee can aim directly at a tangible and immediate objective, while retaining a full, though less direct, share in the final goal. Even more important, the sequential-goals approach recognizes--in terms of incentive pay--the obvious fact that progress proceeds step by step, and that, as the steps build, the final objective becomes more and more attainable. In short, the government is assured that management will be sufficiently interested in the early stages of performance to take prompt and effective action to correct small delinquencies before final delivery targets are jeopardized.

Arguments raised in opposition to the milestoning approach usually claim that few of the interim objectives established have any real relevance to the needs of the customer, who is concerned only with delivery of final item(s). Why, then, attempt to build an incentive pattern around anything in addition to the delivery point(s)? Even

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*Office of Assistant Secretary of Defense (Installations and Logistics), Department of Defense Incentive Contracting Guide (Boston: Harbridge House, Inc., August, 1962), pp. 22-29.

if the preliminary events do have some meaning in themselves, it is claimed, they will inevitably be overstressed in relation to the primary and conclusive objective--final delivery.

A third--and preferred--point of view favors establishing incentive milestones for large and complex systems contracts only, not for the less demanding procurements, where they would be disproportionately costly and would serve little or no purpose. These people feel that traditional objectives--sequenced only to the extent of recognizing the "delivery schedule" and its successive quantity increments--should be perfectly adequate for most awards.

For many contracts, therefore, incentive milestoning offers potential benefit to both parties. Naturally, its use will depend on the contractual requirements, the end item involved and the stage of its development, the relation of the individual procurement to the program of which it is a part, and the relative size, complexity, importance, and duration of the program. Without question, however, the final-goal-only approach to schedule incentives will continue to be employed on the smaller contracts. In either case, the primary objective remains delivery of the end item at or before target; sequential goals--when they are used--should be selected with this in mind.

C. Selecting Sequential Goals

The importance of selecting interim objectives that are meaningful to <u>both</u> parties cannot be overemphasized. The contractor's personnel should see each objective as a key link in the chain of accomplishments, not an arbitrary point chosed in deference to "paper convenience." To the government, each objective should also represent a significant step forward--an achievement that can be measured independently and concretely. This point has important control implications for both sides. Clearly, it should not be possible for the contractor to "meet" the objective while continuing the work under another name. There is a world of difference, for example, between the stated objective: "Deliver one (1) acceptable article" and the objective: "Design freeze." In other words, both contractual parties must make sure that delivery objectives are stated adequately and precisely--failure to do so may create unmanageable administrative complexities.

The task of setting up meaningful interim "schedule incentive objectives" can be made much simpler by recourse to the criteria established for the selection of the "activities" and "events" that compose a PERT (Program Evaluation and Review Technique) planning or reporting network.[1] Establishment of the events demands a rigorous analysis of the proposed schedule (program). Each event must represent the beginning or ending point for some activity or group of activities. PERT evaluators warn against the use of such words as "firm," "finalize," "freeze," and "ship," and suggest more specific phrases--for example, "approve for captive test." The event discription should be explicit and complete, detailing not only what is to be done, but who will will do it, and where it is to take place.

PERT evaluators also suggest that what may be called the "specificity" of each event be given special emphasis. Does everyone involved in the event understand that it is the beginning or ending point of some clearly defined activity? Again, this is an important yardstick. For incentive purposes, however, the schedule developer need not go so far as to require that each incentive objective be antecedent to all further action on the program or contract. This is too rigid a criterion to be applied across the board. If it is used, however, the incentive objectives should be of optimum significance.

D. Establishing Target Dates

Selection of realistic target dates is critical to the success of schedule incentive provisions. If the target dates chosen for objectives (interim, final, or both) are impossibly "tight," or difficult to achieve, the effectiveness of the incentive pattern will be destroyed or the contractor will be encouraged to overemphasize the other incentive elements, such as cost or performance. Conversely, however, if the target dates chosen are too

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[1]In the Pert system, an event--a specific accomplishment in the program, recognizable as a particular point in time--is separated from the next event by an "activity." An activity is defined as a time-consuming element in the development process. It cannot be started until the event preceeding it is completed, and it must itself be completed before the next activity can be started.

"easy," the parties may find themselves in an embarrassing situation later on--embarrassingly bad for the government, and embarrassingly "good" for the contractor. It would seem that the interests of both the government and the contractor would be served best by an approach that focuses on "validity" in the time estimate and recognizes the possible time variances. Here again the concepts of the PERT system are helpful--and the use of PERT itself, or any other comparable system would be desirable (even mandatory) for contractors who are preparing to handle major contracts on an incentive basis.

In a PERT/Cost network, estimates for activity completion times are prepared on three bases: optimistic times, most likely times, and pessimistic times. By calculating the sequences of "expected times" for activities and events, the PERT evaluator can determine the "critical path" of events--the path where time constraints will have the greatest consequences. Many observers believe that the principles of the PERT system apply equally well to schedule-incentive targeting and could be used to great advantage. In essence, these techniques focus upon a balanced consideration of all factors, charting a middle-of-the-road approach to the final objective. As we have pointed out in previous sections, this is the function of a good target--to offer the contractor approximately equal chances of exceeding or falling short of the goal. A target should be set so that the contractor must exert effort and skill to reach it--extraordinary efforts to surpass it. (Certainly, it should not be possible for a contractor to better a "good" target with "poor" performance.) This kind of a target greatly simplifies the problem of profit/fee setting, described immediately below.

E. Structuring the Delivery Incentive

Once an appropriate target date for final delivery has been established, completion of the delivery incentive structure requires negotiation of (i) the range of incentive effectiveness--i.e., the time period before and after target during which the incentive will be operative--and (ii) the formula for determining the fee that will be earned for delivery at various points within this range.

Of primary importance in establishing range will be the program's relationship to parallel programs and to the overall defense effort. In other words, the government must

determine whether or not it is worthwhile to have delivery made in advance of the target date and, if so, at what pretarget point the maximum delivery incentive should be applied. In many cases, early delivery may be of no use whatever; other system components may not be available, test facilities may be tied up, or budgetary considerations may make it inadvisable to step up program expenditure rates. Under these circumstances, the delivery incentive might be written as "penalties only"; the maximum fee attainable would be earned for delivery on or before target and something less than this maximum would be earned for late delivery.

In other cases, of course, early delivery is desirable. (This will usually be true when the item is independent of other systems or is on the critical path for development of an overall system). The pretarget limit of the delivery incentive range, then, would be set at the earliest feasible delivery date within the confines of the contractor's approved design approach and the tentatively established target cost. Naturally, as the duration of the program and the number of uncertainties involved increase, the range between target and earliest feasible date would probably also increase. On a program with a target delivery set at one year from the date of contract award, for example, the earliest feasible delivery date might be one month in advance of target. On a three-year program, delivery six months in advance of target might be equally attainable. In this regard, a PERT analysis, which determines the probabilities of meeting various dates, can be extremely helpful in establishing the appropriate pretarget incentive range.

In setting the other extreme of the delivery incentive range--i.e., the posttarget date at which minimum fee will be earned--it is important to analyze the nature and extent of program uncertainties. The question must be asked, how long might the program take? Again, a PERT analysis, by supplying the "most pessimistic time," can be an excellent guide in setting the point at which the contractor will suffer the greatest reduction in fee for late delivery. If, however, delivery must be made before this most pessimistic time, the incentive should be structured so that minimum fee is earned at some earlier date.

Once agreement has been reached on the delivery incentive range, the only remaining problem is to structure the increased/decreased fee arrangement that will operate

over this range. Almost any pattern is acceptable as long as it meets the particular requirements of the procurement. For example, suppose that the following agreement has been reached regarding the delivery incentive range and the maximum increase and decrease in target fee attributable to delivery:

(i) Range of incentive effectiveness: Plus or minus three months from target date[1]

(ii) Increase in target fee for delivery three months in advance of target: $180,000

(iii) Decrease in target fee for delivery three months following target: $180,000

Two basic possibilities for structuring the incentive pattern in this example are shown in Figures III-1 and III-2.

In Figure III-1 the contractor is rewarded $30,000 for every half month that he betters target delivery and loses $30,000 in fee for every half month that he falls short of target. It should be noted that within plus or minus half a month of the target date, there is a "plateau" during which delivery may be made with no effect on target fee. The existence of such a plateau acknowledges the uncertainty inherent in the time estimate and the fact that deliveries made at any point during the one-month time span would have essentially the same value.

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[1]Of course, range need not be distributed equally on either side of target. The considerations discussed above might easily lead to a range, say, of two months in advance of the target and four or five months following target.

[2]Since delivery incentives are never used unless cost incentives are also operative, the maximum reward and penalty resting on delivery is always determined in the context of a multiple incentive arrangement. Thus, the plus or minus $180,000 swing established above might be the result of giving the delivery incentive a weighting of 25 per cent in a total contractual fee swing of plus or minus $720,000 from target fee. This problem of relative weighting is discussed more fully in Part V. The figures used for the example above are illustrative only.

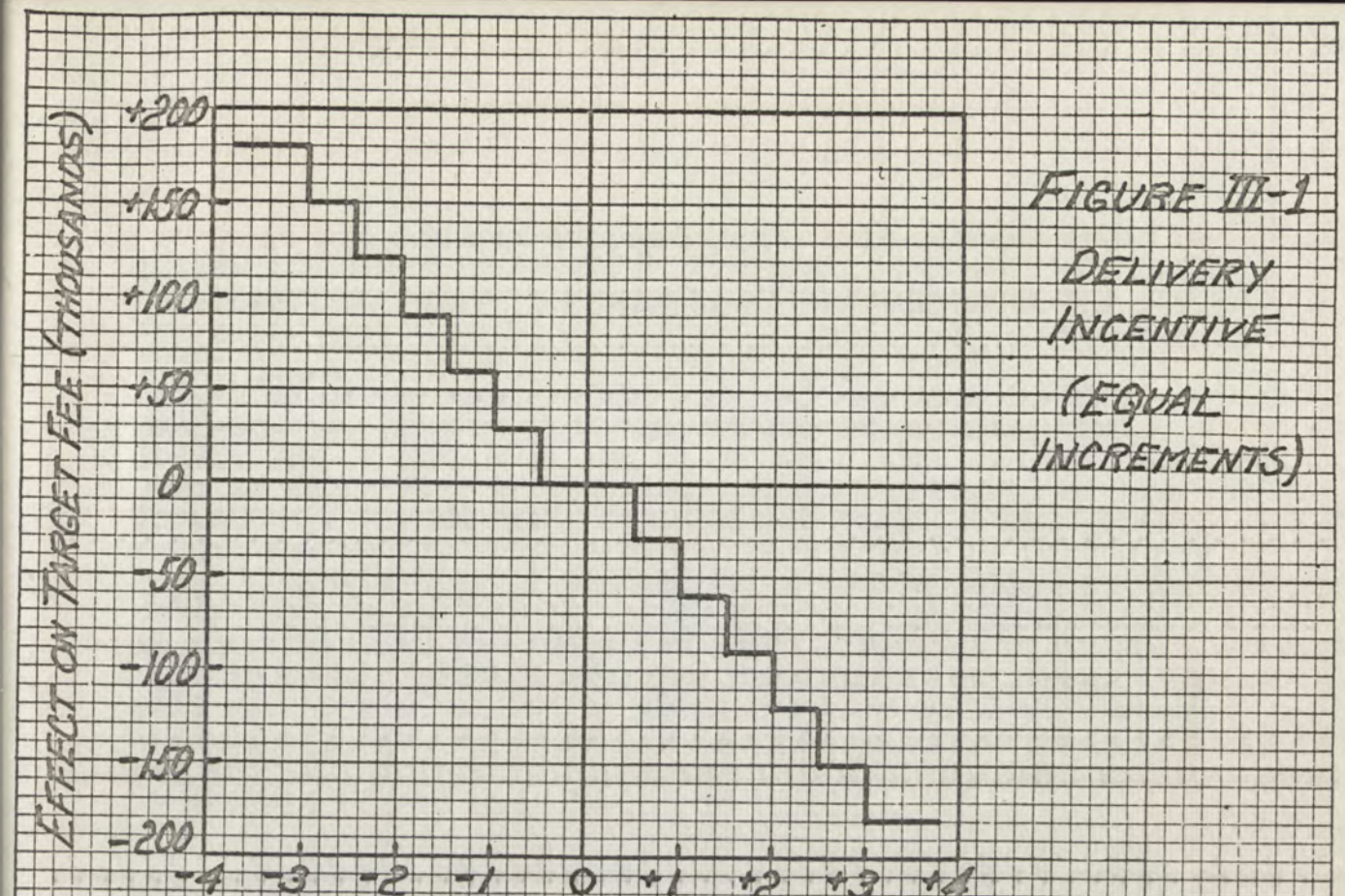

FIGURE III-1
DELIVERY INCENTIVE (EQUAL INCREMENTS)

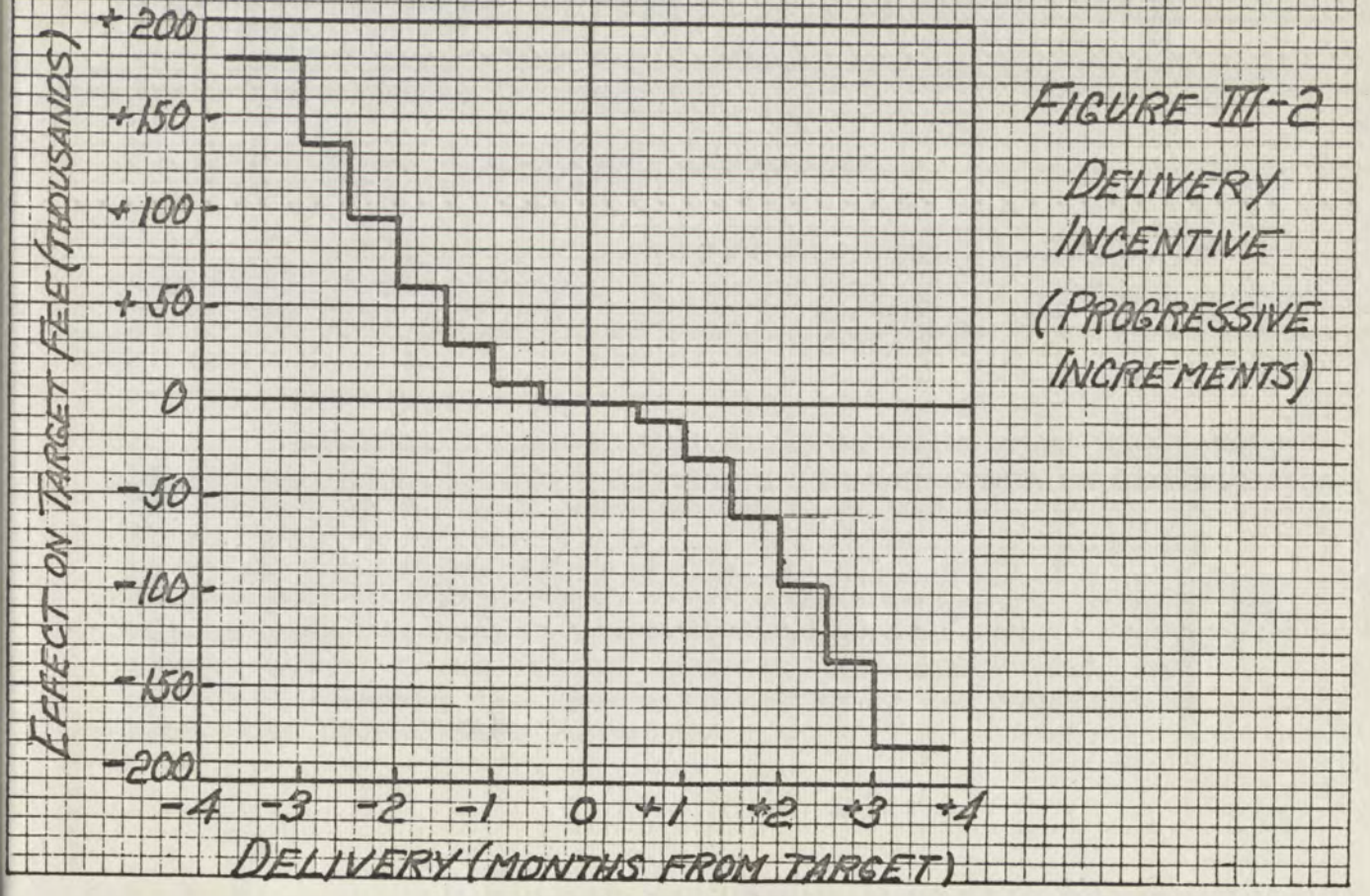

FIGURE III-2
DELIVERY INCENTIVE (PROGRESSIVE INCREMENTS)

In appropriate circumstances, this plateau could be either widened or narrowed.[1] The basic pattern could also be altered to reward (or penalize) the contractor $15,000 for every week that he is early (or late), or $60,000 for every month by which he betters or slips schedule. This selection of the appropriate time unit--weeks, months, half-months, or even days--is vitally important. The increments of time must not be so small that they are cumbersome to administer or that they reduce the impact of the incentive. For example, a contractor might become quite accustomed to the erosion of fee at the rate of $2,000 per day. A single $10,000 penalty for a week's delay, on the other hand, might provide a far greater impetus to avoid missing the next fee reduction point. Naturally, it is equally unwise to have the time increments too large. This will create a situation in which (i) very small differences in delivery date may result in very large differences in fee and (ii) very wide differences in delivery may result in payment of the same fee.

A common variation of the pattern discussed above is shown in Figure III-2. Here the severity of the penalties is increased as the slippage from target increases, reflecting the relative minor importance of small delinquencies in comparison to major slippages. By the same token, delivery in advance of target is rewarded in progressively larger increments, to acknowledge the relative desirability of very early delivery and the increased difficulity of achieving large advances in schedule.

F. Structuring the Delivery Incentive: Sequential-Goals Basis

In addition to all the fee-structuring problems of the final-goals approach, the sequential-goals approach poses the very difficult problem of weighting each of

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[1]Obviously, the plateau could be eliminated completely by having some immediate change in fee dependent on whether the target date itself were bettered or missed. This, in turn, could be written as an extreme go/no-go arrangement by tying the entire swing of plus or minus $180,000 to the single goal of target date. While an arrangement of this type places heavy emphasis on meeting the target date, it offers little incentive to better target significantly and, in addition, removes all future incentive on delivery if, in fact, the target date is not met.

the elements that form the complete delivery incentive pattern. Thus a decision to use interim goals carries with it the question of whether the final goal should still be assigned a commanding or dominant weight. If it is not, of course, the possibility exists that an incentive reward will be "earned" even though final deliveries are late. The problem can be approached in a number of ways. For example, the incentive fee can be "split down the middle," with half the fee allocated to final delivery and half to various precedent or interim objectives. Hopefully, the interplay of final delivery penalties and precedent objective rewards will ensure reasonably balanced possibilities of outcome. Another approach uses a more graduated weighting scheme. To illustrate, the following six schedule objectives were proposed in a recent military solicitation:

		Weight
1.	Complete Program Plan	0.5
*2.	D.E.I.	0.5
*3.	Fire First Complete Motor	0.5
*4.	Begin PFRT Pre-Flight Rating Test)	0.5
5.	Complete PFRT	1.0
6.	Deliver First Flight Test Motor	1.0

It was possible to accumulate a total of four points, which could influence the fee scale by a swing of ± 2 index points:

Index	Fee-Effect Scale
3.6 - 4.0	+2
3.1 - 3.5	+1
2.1 - 3.0	0
1.0 - 2.0	-1
0 - 0.9	-2

The interim objectives were stated as precise points in time. To earn the full value assigned to each date, the contractor had to meet or better the date. A miss gained no credit. Thus, assuming that the contractor attained "schedule"at some point, and then maintained it, it would be possible for him to earn the following point scores:

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*PERT network requirements.

Objective	Weight	On-Schedule Point					
1	0.5	X					
2	0.5	X	X				
3	0.5	X	X	X			
4	0.5	X	X	X	X		
5	1.0	X	X	X	X	X	
6	1.0	X	X	X	X	X	X
Point Total	4.0	4.0	3.5	3.0	2.5	2.0	1.0	0
Fee-Effect Scale Reading		+2	+1	0	0	-1	-1	-2

Analysis of this incentive delivery schedule reveals the following facts:

(i) If the contractor misses any two of the first four objectives, or either one of the last two objectives, he will still get the target fee. However, if he misses both of the last two, more heavily weighted objectives, a penalty situation results.

(ii) The go/no-go test for each of the objectives eliminates the problem of a sliding scale or individual increment of fee attached to late and early deliveries. Thus, the incentive functions with respect to a particular point in time, rather than an incremental or scaled set of dollar values placed upon lateness or earliness. It should be noted, however, that once Item 6 is missed, all incentive to improve delivery is removed.

(iii) The cumulative impact tends to place great importance upon the last two, more significant objectives. Even though schedule is being met, the previous incentive rewards do not materialize until later goals are reached. But once a goal is missed, the opportunity is lost; if the contractor does not attain schedule until the third check point, 1.0 points on the index are gone irrevocably. Target is now the best that can be hoped for, and further slippages will have negative effects. Thus the incentive can be made to operate early in the program, without obscuring the importance of the final goal.

(iv) Selection of a weighted point score system that is then factored into a fee-effect scale ensures that a noticeable value is place upon each incentive goal to begin with. At the same time, the incremental index values of the fee-effect scale can take on whatever dollar value becomes appropriate in view of the total dollars assigned to "schedule" as an incentive objective.

(v) Finally, a clear attempt has been made to select goals that represent key points in completing the contract. Both "contractual" requirements and PERT network requirements are employed as the bench marks.

Another problem that arises in establishing a sequential incentive pattern is the cumulative effect of the pattern.[1] In other words, should the schedule be treated as an entity or as a group of segments? For example, if the contractor advances the first milestone by thirty days, should he be required to hold to this advanced schedule for all following milestones without additional incentives? Or, should the incentive continue to work from month to month around the originally established dates? If the original dates for each milestone are retained, slippage of one may make it impossible to meet any of the others. By making future milestones totally unrealistic in the light of past events, all incentive to improve delivery might thereby be lost early in the contract. On the other hand, if incentives rest solely on the time between milestones, a very substantial reward might be earned even though final delivery is badly slipped.

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[1]The same problem arises when final end-item deliveries will be made over a period of time in certain specified lot sizes.

APPENDIX C

PERFORMANCE INCENTIVES

The following section on Performance Incentives is from the Department of Defense Incentive Contracting Guide.*

PART IV. PERFORMANCE INCENTIVES

B. Selection of Performance Incentive Elements

The process of structuring a performance incentive arrangement must logically begin with the selection of those equipment characteristics that will be incentived. At this point, both the solicitation document and the contractor's technical proposal must be referred to, in order to discover all of the parameters necessary to define the equipment completely. The solicitation may have set forth little more than the mission to be accomplished, thereby leaving the contractor entirely free to specify those performance characteristics that he feels are necessary. On the other hand, nearly all of the critical characteristics may have been enumerated in the solicitation, so that the contractor is limited to outlining his design approach for meeting them. In either case, the two together form the technical base of the procurement. For a missile, they will indicate range, speed, weight, accuracy, reliability, payload, and so forth; for a radio transmitter, frequency tuning capability, power output, weight, modulation characteristics, and a host of other controlling parameters.

Thus, the technical group will have at its disposal a complete verbal description of the equipment as it is visualized. (The description will not necessarily be available in terms of the specific, detailed hardware; more likely, it will be cast in terms of what the equipment will do and, in general, the manner in which this capability "to do" can be achieved.) The group will also have access to test results and research efforts. Finally, it will

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*Office of Assistant Secretary of Defense (Installations and Logistics), Department of Defense Incentive Contracting Guide (Boston: Harbridge House, Inc., August, 1962), pp. 30-37.

have its own knowledge of the state of the art and the role that the proposed equipment must play as part of a larger system or the total defense effort. All of these factors must then be analyzed and the "important" defining parameters isolated, since the existing consensus in DOD is that all these important parameters should be included in the incentive pattern. Any other method would risk overemphasis overemphasis of some characteristics to the detriment of others.

What, then, is an "important" parameter in the framework of selection for incentive purposes?[1] Basically, it is one that meets either of the following criteria:

(i) Some degree of flexibility in the level of performance is permissible and there is real value in obtaining the maximum performance possible under the proposed design approach. In this regard, "value" may represent either dollars saved or an increased capability for accomplishment of the required mission. (Thus, while two critical parameters of a satellite transmitter would be weight and power output, only the former might be incentived. Any saving in transmitter weight would ease the problem of overall satellite development or perhaps allow additional equipment to be installed, thereby increasing the value of a single launch. On the other hand, power output above a minimum of, say, 10 watts might be a needless luxury. By the same token, missile reliability can be translated directly into the number of installed equipments required to ensure that a certain number of targets will be destroyed. The value of increased performance in this case rests not so much on the equipment's ability to carry out a more comprehensive job as in the decrease in total dollar investment required when the equipment becomes operational.)

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[1]Obviously, all equipment parameters are important to some degree. Those not chosen for the incentive aspects of the contract will still be subject to specified limits of acceptability, which must be met but which carry no premium for superior accomplishment.

(ii) Improvement in the particular characteristic is quite feasible under the proposed design and--although this improvement may be of little value to the present equipment--may greatly reduce the scope and cost of more advanced developments that may be contemplated for the future. (This, of course, is in consonance with the government's desire to achieve averall technological progress as rapidly as possible--in fact, to achieve under one contract improvements that might normally take two separate efforts. It should not be used, however, as an excuse to encourage unrelated research effort under development contracts.)

The application of these criteria will yield a preliminary list of those characteristics to which incentives will be applied. (It should be noted that the list will differ substantially from procurement to procurement, depending on the mission, the status of future plans, the type of equipment, and the basic purpose of the procurement. The number of parameters selected may vary from two or three to more than a dozen and those appropriate to one missile or aircraft may not be suitable to another.) This preliminary list must then be checked for redundancy. It may be unnecessary, for instance, to place an incentive on thrust when weight, range, and payload are all to be included in the incentive pattern since outstanding performance in these areas will, of necessity, require improvements in thrust.

C. Defining the Incentive Elements

The satisfactory operation of performance incentives will depend more heavily on the care with which they are defined in the contract than on any other factor. It must be clear to both parties exactly what is meant by each equipment characteristic and how that characteristic will be measured for the purpose of determining fee. The term "reliability" is meaningless until it is phrased in terms of test methods and conditions, confidence limits required, and what constitutes a test "success" or "failure." Even as simple a parameter as aircraft speed, expressed in miles per hour, can be completely defined only by specifying test altitude, instrumentation, loading, atmospheric conditions, and so forth. Thus, before performance targets, ranges of incentive effectiveness, and incentive patterns can be set, government and industry technical personnel must agree completely on those tests which will (i) define

the incentive parameter, and (ii) be used to determine its final value. Unless this is done before the contract is signed, final settlement of the performance aspects of the contract may require recourse to the disputes procedure or, at best, a long and unpleasant series of negotiations.

The test procedures, then, should set forth all of the following:

(i) Method of test. A complete description of the test method must be given, including the instrumentation to be used, the conditions under which the tests will be performed (simulated or actual field environment or laboratory), test duration, data to be taken and standards for data interpretation, whether government or contractor facilities will be used, and how the test apparatus will be calibrated.[1]

(ii) Number of tests. The parties should agree on the number of tests to be made. This is particularly important since, in most cases, it will not be possible to run enough tests to ensure optimum levels of statistical certainty. Both parties should be aware of the effect the limitation may have on computing the incentive fee.

(iii) Personnel conducting tests. Tests may be conducted by the contractor's personnel or by government personnel. Since government personnel may be unfamiliar with the equipment, the contractor will usually find it more desirable to have his own personnel do the testing in the presence of government witnesses. Often, however, the government's best interests or the need to use facilities such as the Atlantic Missile Range may make government participation necessary. In either case, the test procedures should clarify the extent to which the contractor may make special adjustments to the equipment being tested.

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[1]In many instances, reference to standard military test specifications may be adequate to define test methods. These specs should be reviewed carefully, however, to ensure their adequacy under the stringent requirements of the incentive environment.

(iv) Time of measurement. It may also be important to specify the time that the test or measurement is to take place. For example, performance measurement may be limited to the first article provided either before or after acceptance. In other cases, evaluation of reliability may be made only after a certain stated period of testing or operational use. Or measurement of performance may be deferred until the entire system has been assembled or integrated. (From an administrative viewpoint, it is simplest if provision is made for a single point at which development work will cease and the equipment will be subjected to the full test series for the purpose of determining both acceptability and incentive fee. This single point is left to the contractor, who must decide, on the basis of his own tests, when it is most advantageous to accept existing levels of performance rather than spend additional time and dollars. On the other hand, development of certain types of equipment will not permit delineation of a single cutoff date. A reasonable sample size for the determination of missile reliability, for example, may require that all test results--including early static tests--be factored into the final reliability calculation. Furthermore, on programs of long duration, it may be desirable to apply some performance incentive fee before the job is completed. Thus, if the schedule calls for specific, definable technological accomplishment at some point before final delivery, a portion of the performance incentive fee could be applied then in the same manner that interim delivery incentives are applied.

(v) Acceptance or exclusion of tests. Where necessary, the procedures should indicate those conditions under which test results will be accepted for purposes of fee determination and under what conditions they will be rejected and the test performed again without penalty.

(vi) Effect of failures not attributable to the contractor's equipment. Insofar as practical, the procedures should enable failures attributable to GFP, test personnel, or test facilities to be identified and segregated from those for which the equipment itself is clearly responsible.

D. Structuring the incentive pattern

Once the performance incentive elements have been selected and defined, final structuring of the incentive pattern begins. This consists in setting for each element (i) its weight relative to the other performance elements,[1] (ii) a target, (iii) a range of incentive effectiveness, and (iv) a reward/penalty arrangement.

In the performance-incentive area, unlike either cost or schedule incentiving where targets are negotiated first, it is probably more reasonable to begin by setting the range of incentive effectiveness. The lower limit of each incentive range should be established by government engineers at the minimum acceptable level for that parameter. Care should be taken to set these minimums so that the equipment will still be satisfactory even if the contractor does poorly on all the elements. The upper limit of each range should represent the maximum performance attainable within the confines of the contractor's technical proposal. The upper limits should not require any significant technological breakthroughs or variances from the design approach as set forth in the proposal. It follows that the upper limits will be the subject of lengthy negotiation between the government's and the contractor's technical personnel. Just as the aggregate of minimum performance levels must define an equipment acceptable to the government, so the aggregate of maximum performance levels must be achievable within the scope of the procurement. If the contractor, for example, cannot achieve maximum speed without sacrificing maximum performance of some other element, he will have no chance whatever of earning maximum fee.

After the ranges have been established, the next step will be to fix targets for each element. It is difficult to say with assurance what criteria should be used here, particularly since both government and industry are accustomed to the CPFF situation in which specification targets are coincident with acceptable minimums (at least

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[1] Weighting of the overall performance incentive relative to cost and schedule is discussed in Part V. Relative weighting here refers only to the weighting relative to other performance elements.

at the outset, before waivers and compromise become necessary).[1] Several considerations, however, bear on the problem. When the request for technical proposal contains values for various performance characteristics (rather than simply outlining a mission to be performed by the equipment), these values, for the most part, should be suitable targets since they will have been used as targets by the contractor in the preparation of his proposal. When the proposal itself is the primary source of quantitative information, targets should be set at that performance level which represents "normal" technological risk. Or where this cannot be determined satisfactorily, it may be necessary to negotiate cost and delivery targets for various possible levels of target performance and then select the most desirable combination of all three. Is is obvious that these considerations will not necessarily lead to targets that are equidistant between maximum and minimum performance.

The final steps in structuring the performance incentive are assigning relative weights and setting the reward/penalty formula.[2] The former is largely a matter of judging the relative values of improvement in each equipment characteristic. Like the selection process, the weighting of performance incentive elements demands careful analysis of the mission to be performed and the degree to which incremental improvements in performance will enhance the equipment's capability to perform that mission. Or, if it is possible to place a dollar value on incremental performance, this value can be used to establish an appropriate relative weight. It is not necessary, however, for the relative weighting to reflect precise quantitative appraisals of the various performance elements.

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[1]Even in the incentive environment, for those parameters where the contractor is required to "push the state of the art," the minimum acceptable may be high enough to warrant its use as target. In this case, a rewards-only arrangement would be appropriate.

[2]Both of these steps must be preceded, of course, by negotiation of a contractual target cost, target fee, maximum and minimum fee, and the assignment of relative weights to cost, schedule, and performance. These factors are discussed in detail in Parts II and V.

The desired goal is to decide which of the elements are of paramount importance and to give them a significantly higher weight than the others receive. When and if trade-offs become necessary between performance elements, there should be no question but that the contractor will emphasize the most important one(s).

As to the final step of setting a reward/penalty formula, any of the patterns discussed in Parts II and III for cost and schedule may be used where appropriate. The arrangement may be a simple straight line as shown in Figure V-1 or a progressive pattern that reflects the relatively higher value of large improvements over target and the undesirability of performance substantially below target (see Figure V-2). The "plateau" area of a progressive pattern may, of course, be a 100-0 share line in situations where small deviations from target are inconsequential or will result more from technological "chance" than engineering skill. Under no circumstances should the plateau be so wide as to weaken the impact of the incentive arrangement.

A variation on the straight line pattern is the application of rewards and penalties in discrete steps; i.e., by dividing the performance range into increments and allocating equal or progressive amounts of incentive fee to each. Assume, for example, that the target weight of an item is set at 5,000 pounds, the maximum weight at 6,000 pounds, and the minimum weight at 4,000 pounds. This range of plus or minus 1,000 pounds from target might be divided into fifty increments of 40 pounds each. If the range between maximum and minimum fee for the weight incentive is set at $10,000, a penalty of $200 would be deducted from the target fee for every 40-pound increase in weight. Similarly, the contractor would receive $200 for every 40-pound decrease in weight. Or, if a progressive pattern is to be used, the contractor might receive $50 for each of the first five 40-pound reductions in weight, $100 for the next five, and so on. When this arrangement is used, unreasonably large changes in fee that turn on a single performance point must be avoided. In the straight line patterns, for instance, it will make little difference whether the final speed of an aircraft is determined to be 999 mph or 1,001 mph. With a pattern structured in discrete steps, however, this difference might be critical if a significant fee change occurs at 1,000 mph. Final agreement on speed might be extremely difficult, particularly if the test apparatus is known to be accurate only to within, say, plus or minus two miles per hour.

APPENDIX D

MULTIPLE INCENTIVES

The following section on "Problems of Multiple Incentives and Split Responsibilty" is taken from the Department of Defense Incentive Contracting Guide.*

PART V. PROBLEMS OF MULTIPLE INCENTIVES AND SPLIT RESPONSIBILITY

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... How, then, should these two factors--range of incentive effectiveness, and relative weighting--be determined in a specific contractual situation?

To begin with, neither factor will become critical until quite late in the negotiation cycle, by which time the contractor's technical proposal will have been analyzed and modified; the performance incentive parameters will have been selected and defined; targets and ranges of incentive effectiveness for these performance parameters will have been established (as discussed in Part IV); based on the performance targets, a target cost and a target delivery date will have been negotiated; and, finally, agreement on maximum and minimum fee will have been reached.[1] For instance, on a typical aircraft development program, the following tentative agreements might have been made:

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*Office of Assistant Secretary of Defense (Installations and Logistics), Department of Defense Incentive Contracting Guide (Boston: Harbridge House, Inc., August, 1962), pp. 38-45.

[1]None of these agreements, of course, will be final until the entire contract has been discussed. Nor is it necessary for the negotiation to proceed in the sequence outlined above. Discussion of maximum and minimum fee, for example, might well be postponed until further negotiation has provided a clearer definition of what specific results--in terms of cost, delivery, and performance--will represent "maximum" and "minimum" accomplishment.

a. Performance Incentive

Parameter: Speed[1]

Target: 1,000 mph

Maximum Achievable: 1,150 mph

Minimum Acceptable: 850 mph

b. Target Cost: $100 million

c. Target Fee: $8 million

d. Maximum Fee: $14 million

e. Minimum Fee: $2 million

f. Target Delivery: 30 months from date of contract

It must now be asked, "At what combination of cost and delivery should the contractor be awarded maximum fee if, in fact, the aircraft achieves a speed equal to, or greater than, 1,150 mph?" and, "At what combination of cost and delivery should he receive minimum fee if only 850 mph is achieved?"

In answer to the first question, Part II stated that, under a cost incentive, the maximum fee should be earned at that cost which represents the greatest deviation from target cost that may be expected. Similarly, Part III suggested that the maximum fee attributable to delivery should be earned at the pretarget date that is the "earliest feasible." Obviously, neither of these statements is adequate in the context of a multiple incentive arrangement, for now the performance level to which they refer has itself become variable. The question must be asked, therefore: Do these two factors (the lowest expected cost and earliest feasible delivery) relate to equipment that meets minimum, target, or maximum performance? To answer this question, we must refer to the first basic purpose of the multiple incentive contract as set forth above--encouraging outstanding results in <u>all three</u> incentive areas. From this we

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[1]For purposes of this illustration, the number of performance parameters has been limited to one.

can deduce that the cost at which maximum incentive fee is earned should be the lowest cost at which maximum equipment performance might be achieved, and the pretarget date at which the maximum delivery incentive is paid should be the earliest feasible date at which equipment of highest performance might be completed.[1] If the cost/delivery requirements at which maximum fee is earned are made any more stringent, the contractor will have no hope of achieving the maximum contractual fee and will be compelled to aim at less than outstanding results in at least one of the incentive areas. It should be emphasized, however, that the combination of performance, cost, and delivery at which maximum fee is earned should demand genuinely outstanding effort and success in all three areas.

Unfortunately, it is more difficult to define the cost and delivery date at which minimum fee should be received--i.e., the upper limit of the cost and delivery ranges of incentive effectiveness. The same questions that apply in setting the lower limits might also be asked here. (Should the minimum cost incentive fee be earned at the highest expected cost for minimum, target, or maximum performance? and so forth.) But the answers are likely to prove irrelevant in view of funding limitations or program urgency. In most cases, therefore, it will be sufficient to set these upper limits in relation to target performance in accordance with the criteria discussed in Parts II and III.

Assume, then, that the considerations outlined above lead to establishment of the following ranges of incentive effectiveness for cost and delivery:

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[1]In general, the earliest feasible delivery date and lowest expected cost for achievement of maximum performance will not be substantially different from the earliest feasible delivery date and lowest expected cost as they relate to target performance. Since the contractor's design effort will be constrained by his technical proposal, superior equipment performance should result more from his technical skill in carrying out this proposal than from the expenditure of additional time and/or money. However, since obtaining the maximum results from a given design will require some additional rework and refinement, it is felt that this fact should receive recognition in the contractual structure in the manner discussed above.

a. Cost: From $70 to $130 million

b. Delivery: From three months in advance of target date to three months following target date.

The next problem is establishing the weights to be assigned to each incentive objective.

Part I provided a general approach to this problem of determining the appropriate division of the total incentive swing between the incentive objectives (cost, schedule, and performance). As an item proceeds from development to prototype to production, incentive emphasis will usually shift from performance to delivery and cost.[1] Thus, the problem of the relative emphasis to be given the three incentive factors is determined largely by the existing stage of equipment development and/or production. (It seems evident, moreover, that the customer--i.e., the government--should have the prerogative of specifying, with little opposition from the contractor, what these relative weights will be.) It is when the parties attempt to translate these decisions regarding relative emphasis into a specific multiple-incentive pattern that complex problems arise.

It should be remembered that the real impact of weighting will be felt at that point in performance when the contractor recognizes that optimum results cannot be achieved in all three incentive areas. Here he must make decisions regarding the advisability of spending additional time and money (at some reduction in fee) in order to improve

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[1]This concept may not, of course, be applicable to all situations. For example, if the development of a major subsystem lies on the critical path for development of the total system, it may be that the subsystem contract should place major emphasis on delivery rather than performance since time spent to achieve desirable but unnecessary performance improvements may cause unacceptable delays in overall system completion. By the same token, cost incentives may also warrant very little emphasis in the subsystem development contract; here the extra cost of early subsystem delivery might well be offset by reducing or eliminating any hiatus in total system development.

equipment performance (thus earning additional fee). And the break-even point between decisions to commit or not to commit further time and money will be determined by the weights assigned the three incentive areas.

Suppose, in the hypothetical example discussed above, that the contractual structure is completed by assigning weights as follows:

Performance: 50%

Schedule: 25%

Cost: 25%

Then--if the structure of each incentive pattern is a simple straight line--the final contractual arrangement would be as shown in Figure V-1. Suppose, further, that the contractor expends $80 million, completes testing the aircraft three months before target delivery, and records a maximum speed of 950 mph. He must now determine whether to submit the equipment for acceptance or to continue further development. If, for example, he estimates that $10 million and two months' additional effort will increase the speed by more than 75 mph, then it will be to his advantage to perform the added work, since there will be a net increase in the fee received.[1] In view of the amounts of money and time that are being invested in incremental improvements in performance, it goes without saying that the government must be sure that this "trade-off matrix" is reasonable before the final weights are assigned. In the example given above, if 75 mph additional speed is not worth $10 million and two months' time, then the weighting should be changed to emphasis cost and delivery more heavily. In most cases it is extremely difficult to place a dollar- or time-value on these increments of performance. The important thing is not so much to make the evaluation with any great precision, but to prevent a weighting pattern

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[1]In the situation outlined above, some contractors might require an improvement is speed substantially above 75 mph so that both the ratio of fee earned to cost expended and the absolute dollars would be greater.

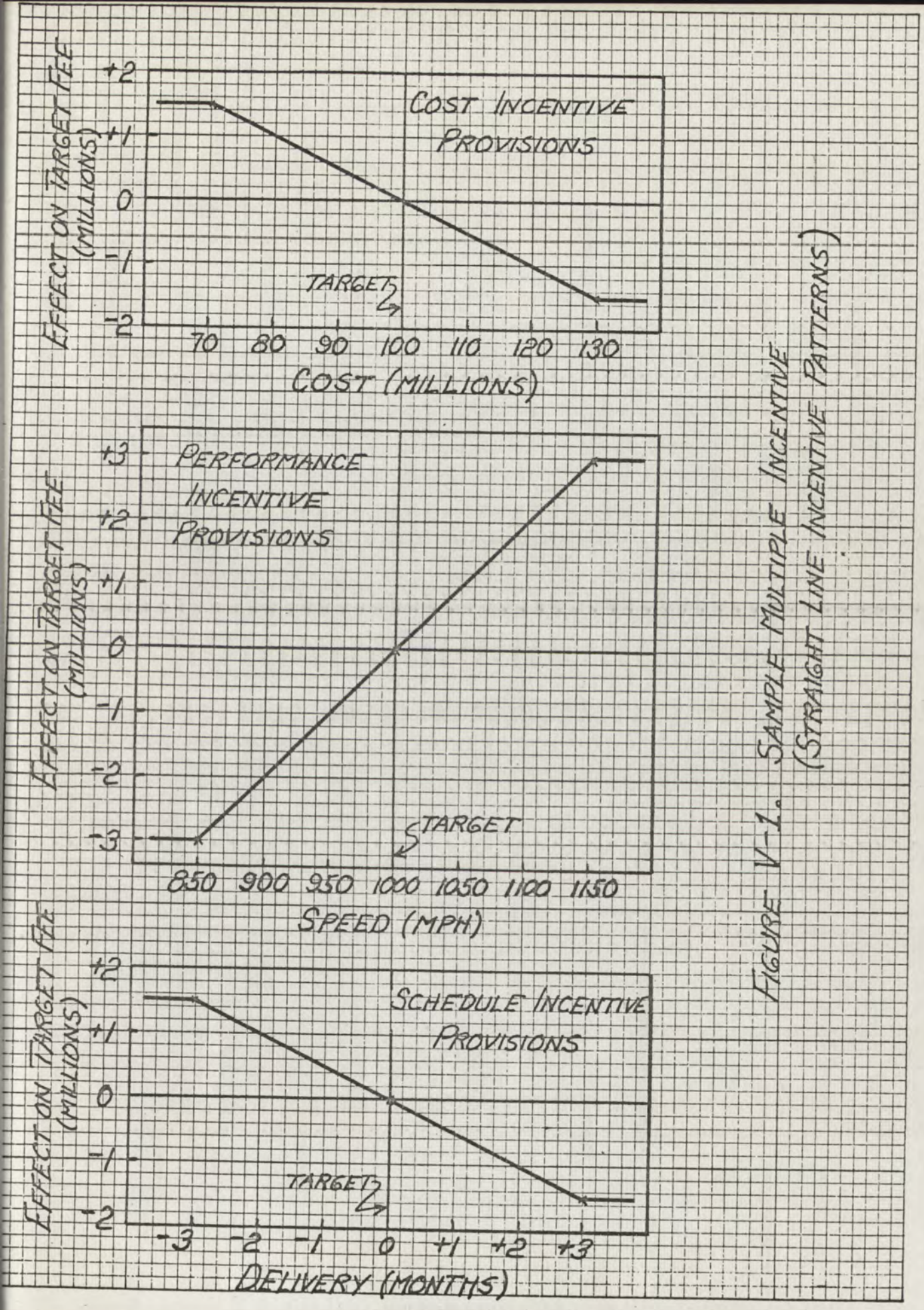

FIGURE V-1. SAMPLE MULTIPLE INCENTIVE (STRAIGHT LINE INCENTIVE PATTERNS)

that may produce contractor trade-off decisions that are obviously not in the government's best interests.[1]

It is important to note that the contractor's trade-off decisions may not be conditioned by fee alone. Part II, for example, discussed the impact on cost decisions of a situation in which the contractor was operating at less than capacity. These same considerations may be operative in the multiple-incentive environment, making it necessary to place greater weight on cost in order to create the same break-even point in the trade-off matrix. Similarly, when the contractor is involved in a highly technological environment, he may be willing to sacrifice fee for the sake of performance improvement, thereby committing large amounts of the government's money to achieve only minor advances in technology. This tendency can be counteracted by increasing the weight given to the cost and schedule incentives. Finally, the contractor's past record may make it necessary for the government to lay particular stress on one incentive or the other if a desirable balance is to be achieved. The "high cost producer," for example, may require greater weight on cost, and the consistently delinquent company greater weight on schedule.

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[1]Naturally, the trade-off matrix will be affected by the use of progressive incentive patterns as well as the weighting of incentive objectives. If, for instance, the contract were structured as shown in Figure V-2, decisions to spend additional time and money would be greatly affected by the contractual situation that existed when the decision was being made. If the contractor arrived at situation A ($70 million expended, three months ahead of target, and a speed of 900 mph) and estimated that two months and $10 million more would increase speed by 100 mph, he would probably decide not to perform any more work, since by doing so he would incur a net reduction in fee of $950,000. But if he made the same estimate ($10 million and two months for 100 mph) at situation B ($90 million expended, one month ahead of target, and a speed of 850 mph) his decision would probably be to perform the additional development, since he would increase his fee by $1.9 million. Again, it is important that the decisions be in consonance with the government's best interests and that the combination of weighting and progressive structuring eliminate any chance of making decisions that are clearly contrary to this best interest.

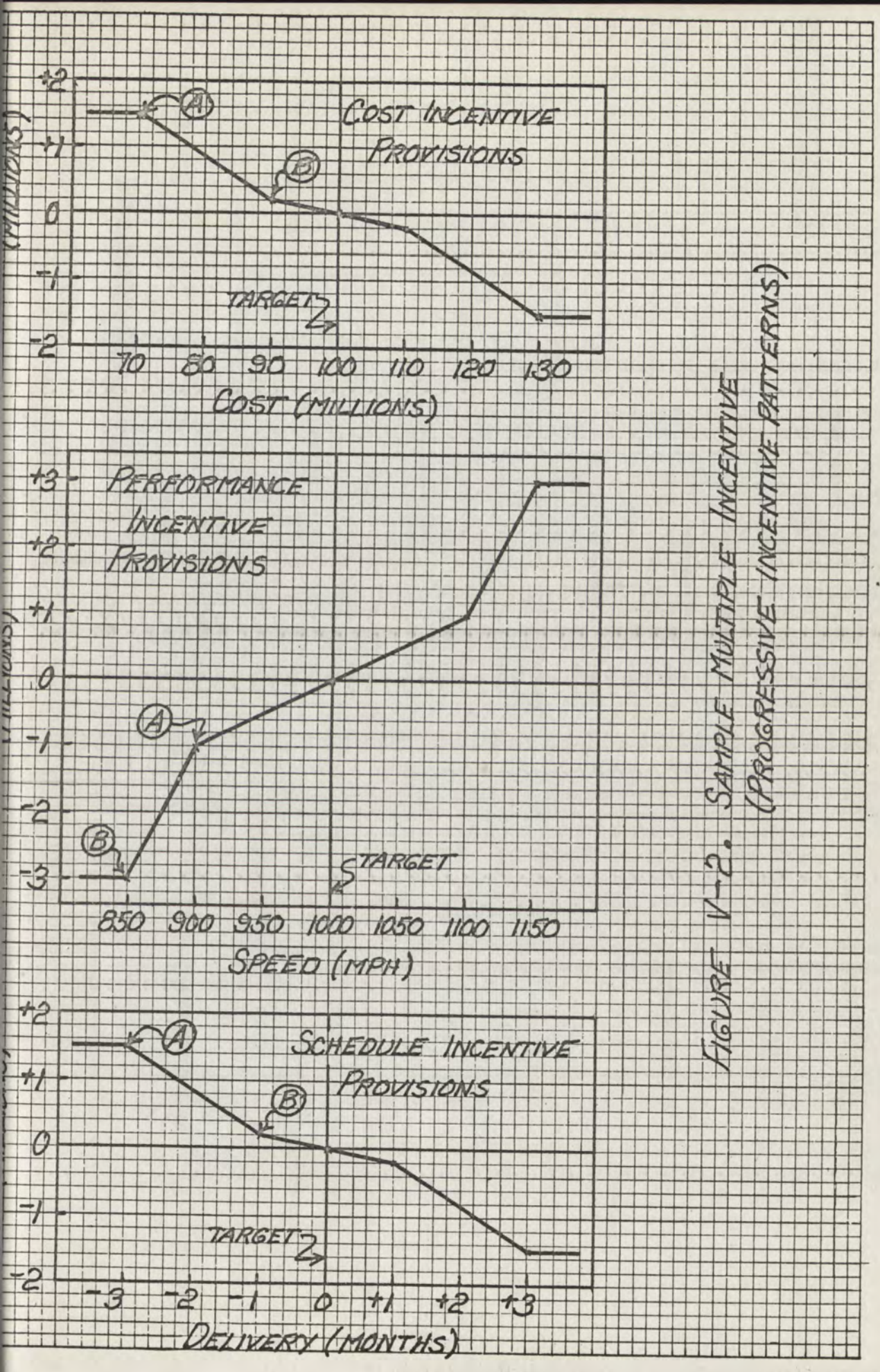

FIGURE V-2. SAMPLE MULTIPLE INCENTIVE (PROGRESSIVE INCENTIVE PATTERNS)

Obviously, it is not easy to derive a multiple incentive matrix wherein the most profitable trade-off decision for the contractor will always be coincident with the decision that DOD would prefer. In fact, as conditions change during contract performance, the interrelation between the incentive elements may also change; and a relative weighting pattern that was suitable when the contract was awarded may be less satisfactory at a later time. (For example, substantial changes in capacity conditions through the addition, or loss, of business may affect the operation of the original cost incentive provision.) It is DOD's intent, therefore, not to view the incentive contract as an opportunity for contractors to maximize profits by taking whatever course of action offers the greatest return at a given time during performance. Thus, a contractor who optimizes profit under one contract by ignoring one or more of the government's stated objectives may find that his action may adversely affect his selection for future contracts.

Another basic question that multiple incentives prompt is whether or not the effect of the incentive elements, working in combination, should be allowed to overlap. In both Figures V-1 and V-2, the individual incentives are completely compartmentalized. In other words, if the contractor delivered a 1,150 mph aircraft three months after target at a cost of $130 million, he would receive target fee, and if he delivered the same high performance aircraft six months late at a cost of $160 million, he would still earn target fee. The fact that cost control and delivery were exceptionally poor in the second case would not affect the $3 million reward for highest equipment performance. Viewed another way, the same fee would be paid for very different levels of overall contractual performance, and, even more important, once the contractor had expended $130 million, all incentive to control cost would end. In fact, at that point the contractor might be tempted to spend very large amounts to achieve improved equipment performance, and the greater the weight placed on the performance incentive, the greater will be his tendency to spend additional funds once the cost incentive has run out. It is questionable, therefore, whether the CPIF multiple incentive arrangement with compartmentalized incentives can discourage the "buy-in" practices and disproportionate cost overruns so prevalent in CPFF contracting.

Fortunately, this problem can be lessened by including some amount of overlap at the upper limit of the cost

incentive provision.[1] In the example cited above, for instance, the cost incentive penalty would continue to increase indefinitely as actual costs exceeded $130 million (see Figure V-3). Now, if the contractor delivers a 1,150-mph aircraft six months late at a cost of $160 million, he will earn not target fee, but $1,5 million less than target. In other words, some of the potential reward for superior equipment performance has been lost because of the cost overlap feature and the fact that cost control has been exceedingly poor. And regardless of how high final costs may be with respect to target, the cost incentive provisions will continue to be operative. For this reason, it is DOD policy to incorporate cost overlap in CPIF multiple incentive contracts wherever possible. (It should be noted that the contractual minimum fee of $2 million has not been changed because of the addition of overlap. Thus, if an 850-mph aircraft were delivered six months late for $160 million, the contractor would still receive $2 million of fee rather than $500,000 as indicated by the overlapping multiple incentive arrangement. Furthermore, in the example, the slope of the cost-sharing line above $130 million would not necessarily be the same as the slope below $130 million but would be the subject of negotiation.)

Characteristically, the existence of a ceiling price in FPI contracts builds overlap into the contract form itself. Figure V-4 illustrates a typical FPI cost-incentive arrangement. As shown in Figure V-5, a delivery incentive provision has also been incorporated, providing a $250,000 reward or penalty for every month that delivery precedes or lags behind target. Now, if the contractor delivers two months early, but his costs exceed $111,862,500, the operation of ceiling price will prevent him from receiving the full $500,000 delivery incentive. And, if his costs exceed $112,500,000, he will be ineligible to receive any schedule incentive award, no matter how early he makes delivery.

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[1]Conceivably, the concept of overlap could also be applied to the delivery incentive. However, because cost incentive overlap will also tend to control extremely late delivery, current DOD thinking is to limit the use of this concept to the cost area. Furthermore, contractors may be expected to demand some compensation for accepting the increased risk inherent in overlap. They may, for instance, expect high target, maximum, and minimum fees or they may ask that overlap be applied to the lower limits of the cost incentive as well as the upper limits.

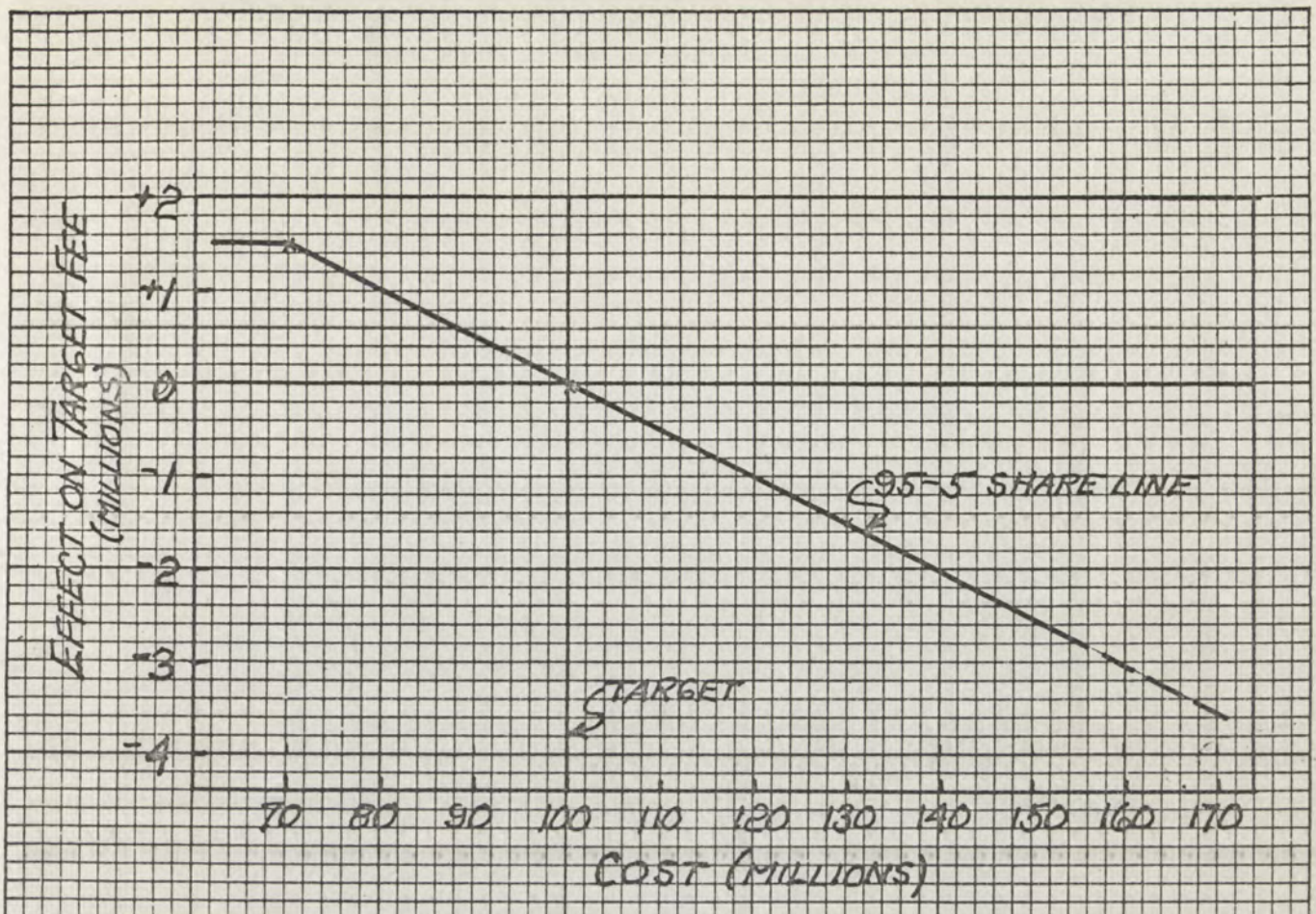
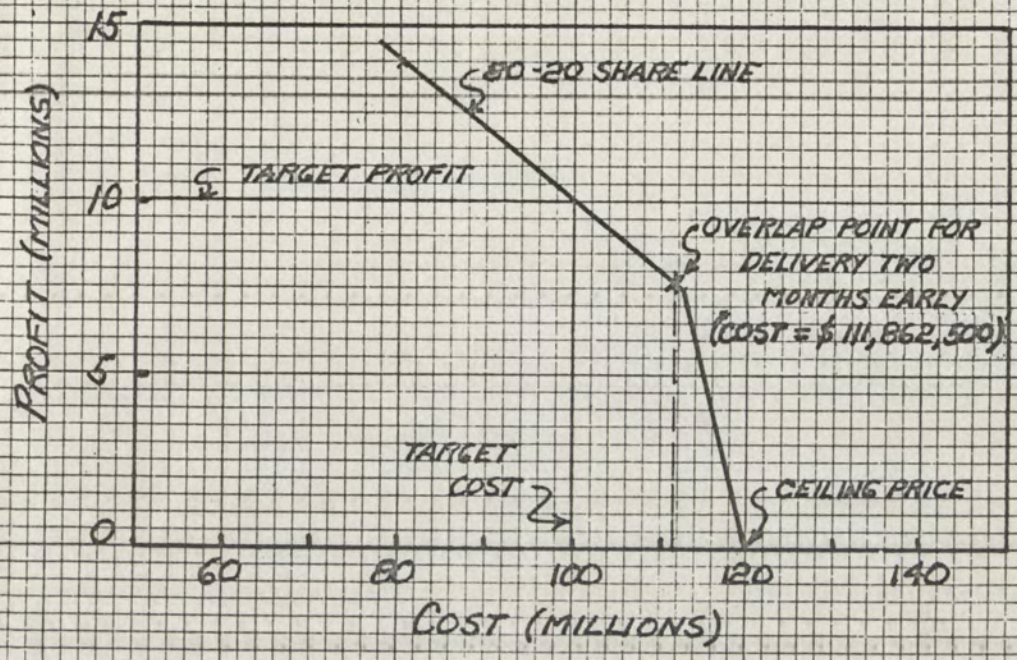


FIGURE V-3. ALTERNATIVE COST PROVISIONS FOR USE IN FIGURE V-1 IF COST OVERLAP IS DESIRED.

FIGURE V-4

FPI COST INCENTIVE PROVISIONS



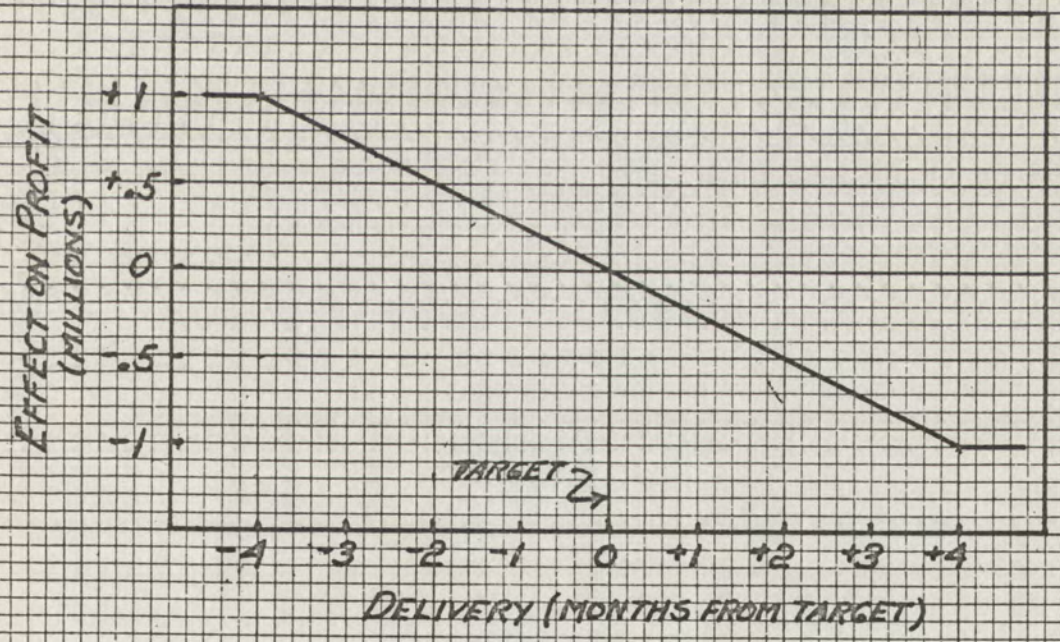


FIGURE V-5

FPI DELIVERY INCENTIVE PROVISIONS

This situation could be avoided by writing the contract so that a $119 million ceiling would be effective for cost-incentive purposes, and a $120 million ceiling for the two incentives combined. If this is done, however, the contractor will lose a portion of his protection against overruns; for example, if he delivers on the target date and costs are $118 million, he will be paid $119 million rather than $120 million.

B. Split Responsibility

It goes without saying that, in nearly every procurement situation, the government is more interested in the overall performance of a system than in the characteristics of the individual subsystems or components. To the extent that it can, then, the government will wish to condition incentive awards and penalties on this overall performance. When a single prime contractor is given total system responsibility, there is no reason why he should object to incentive provisions made on a total-system basis. Often, however, a single prime is not given complete responsibility, and we have a situation in which the government still depends on overall results, but the individual contractor has only partial control over those results. Naturally, under these circumstances, the contractor will want to limit the application of incentive provisions to his portion of the total system. A situation like this may occur for a number of reasons:

(i) The contracting agency may wish to retain override authority on design decisions during the development stage.

(ii) Two or more prime contractors may be involved in the total system effort.

(iii) Parts of the system may have been developed previously and will be supplied as GFM.

Obviously, the first situation is one of degree since the government will always retain <u>some</u> authority over the design effort. Under normal circumstances, when <u>most</u> decisions will be made by the contractor, the problem can be handled only by judicious administration of the contract as discussed in Part VI. In those circumstances where development objectives are so uncertain that choices cannot reasonably be left to the contractor and the government expects

to take an active part in directing the design work, a CPFF contract will probably be more appropriate.

The problems presented by situations (ii) and (iii), above, are somewhat different, since no contractor will want to be penalized because someone else's subsystem causes poor performance of the overall equipment. The only solution here is to analyze these interface problems carefully and then negotiate incentives that are as independent of other subsystems as possible.