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SUMMARY

During the past three years there has been a concentrated effort by the Government to shift from Cost-Plus-Fixed Fee Contracts to Incentive Contracts. The basic purpose of this shift is to put more of the burden of financial risk on the contractor and to reward contractors who successfully perform on their contracts with higher profits.

Another trend is developing of combining R&D, Production and Logistics Support into a single contract based upon Air Force Secretary Charles' "Total Package Concept".

Since the purpose of these changes is to shift more risks from the Government to the Contractor, the tendency is often to select the type of contract whereby the contractor assumes the maximum risk. This of course is the Fixed Price Contract. However, due to the nature of the circumstances surrounding the procurement, the Fixed Price Contract may not be the most appropriate nor in the best interests of the Government.

The purpose of this Article is to describe a type of Contract for use when it is desired to combine R & D and Production in a single contract. In designing this contract, it is a goal to reduce or eliminate problems which have caused concern to the Government and still not go to the extreme and require the contractor to assume more risk than sound business judgment would dictate.

COMBINING R & D AND FOLLOW-ON PRODUCTION IN A SINGLE CONTRACT

As a result of Defense Secretary McNamara's famous 11 July 1963 Press Conference on cost reduction, there has been an intensive effort by both DOD and NASA to shift from Cost-Plus-Fixed-Fee (CPFF) to Incentive Type Contracts.

Since Government procurement envelops the total span of the research and development spectrum as well as the procurement of hardware and services, it is obvious that one type of contract will not fit all procurement situations. It is also basic to our free enterprise system that high incentives breed high performance.

There is no argument with the basic principles involved in the shift from Cost-Plus-Fixed-Fee to Cost-Plus-Incentive-Fee, Fixed Price Incentive and Fixed Price Contracts. However, the selection of the type of contract should be based upon the circumstances of the specific procurement and not by pressures external to the procurement. Consideration must be given to such things as:

1. Is the requirement within the state-of-the-art?
2. Is the work sufficiently defined to permit accurate pricing?
3. Is there sufficient cost history to permit accurate pricing?
4. Are there unknowns which require large contingencies in pricing?
5. What are the possible maximum and minimum costs?

Instead of basing the type of contract on the above, the type of contract is often influenced by the following:

1. Meeting statistical goals showing a shift toward Incentive and Fixed Price contracts.
2. Inadequate project funds or internal administrative directives and pressures do not permit the Government to assume the risk of a cost overrun. Hence, straight Fixed Price is used where, based on the conditions surrounding the particular procurement, CPIF or FPI should have been used. Use of a contract type of a higher order than is appropriate for the procurement conditions requires the contractor to either bit a large contingency or assume a higher risk than sound business judgment would dictate. In such cases the small but perhaps more efficient businessman must no-bid because he cannot afford to take such a risk. The result is a restriction on competition and a strong possibility of higher overall cost to the Government.

In the past, DOD has used the following guidelines for determining the type of contract appropriate for a particular procurement:

CPFF — Research programs where the state-of-the-art is being pushed and feasibilities proven.

CPIF — Development programs and some initial production. Development programs, by definition, will have no state-of-the-art problems, satisfactory specifications, and will merely require management of engineers.

FPI — Initial production where cost data is not sufficient to permit fixed price.

FP — Production where competition or cost data is sufficient to determine fair and reasonable price.

During the past year some agencies of Government have been giving consideration to combining the R & D phase and the production phase in a single contract. Some of the reasons given for this are:

1. The desire to have the initial production accomplished by the R & D contractor because of the R & D contractor's knowledge of the program technical requirements.
2. Too much time is lost between the R & D phase and production phase if a new competitive procurement cycle must be run prior to production.
3. Unless an initial production is accomplished by the R & D contractor, production drawings are not sufficiently accurate and complete to permit a new competitive procurement which will be void of scope changes caused by incorrect drawings and specifications.
4. When R & D is procured separately, the R & D contractor may "buy-in" on the R & D contract with the expectation of recovering losses on a sole source production follow-on.

Since a combined R & D and production contract on a CPFF, CPIF or FPI basis still permits the use of the "buy-in" technique, the trend has been toward Fixed Price even though the procurement may involve substantial development, no cost history, and many cost unknowns.

It therefore appears that a new type of contract is needed to cover combined R & D and production contracts which involve high financial risks and cost unknowns. It is the purpose of this article to describe such a contract.

In developing a contract for this type of procurement, consideration should be given to the following requirements:

1. The contract should discourage buy-in on the R & D phase with the goal of making up losses on production.

2. The contract should discourage inflating costs in the R & D phase with the view of obtaining a higher price on the production phase.

3. The contract should protect the contractor from severe financial loss due to unforeseeable circumstances which are beyond the control of the contractor but inherent in a development program with many cost unknowns.

4. Protect the contractor from default on the production phase because the R & D phase turns out to be an impossible task.

The proposed contract consists of two phases. Phase I (R & D) for the design development fabrication and test of the first unit or system inlcuding all required documentation such as drawings, specifications, manuals, test procedures, spare parts lists, etc.

Phase II is for the follow-on production.

Phase I for the R & D could be either Cost Plus Fixed Fee, Cost Plus Incentive Fee, Fixed Price Incentive or perhaps Fixed Price depending upon the final specifications negotiated.

There are some advantages offered to the Government by each type not offered by the others.

The CPFF offers greatest flexibility for technical direction by the Government but at a sacrifice of cost control.

The CPIF has been found generally to be more suitable for R & D because of the administrative flexibility desired where there may be numerous scope changes which often occur as the development program progresses and which require fast reaction but at the same time contains incentive for cost control. CPIF is also more of a best efforts contract which is used where technical achievement may not be possible.

The Fixed Price Incentive offers to the Government the advantage of a maximum price for which it will be obligated. It also requires specific performance by the contractor in that all specifications must be met. If they are not met the Government has a choice of defaulting the contractor or reducing the specifications to those actually achieved.

This type of contract is very risky for the contractor when it is known in advance that state-of-the-art is involved.

The Fixed Price contract is essentially the same as Fixed Price Incentive except the contractor must include in the price an allowance for contingencies. If the contingencies do not occur then the allowance becomes profit.

Final determination on the type of contract for Phase 1 should be a part of the contract negotiations.

Phase II for the production could be included as a part of the original contract or as an option in the original contract. The advantage of including Phase II as an option is that at the conclusion of Phase 1 the Government may elect not to exercise the option and go out on competitive bids without having to go through termination proceedings. Whether an option or as part of the basic contract, the contractor is not liable for Phase II until phase 1 is accepted.

The type contract for Phase II would be Fixed Price Incentive with successive targets. This is not a new type contract because it is currently contemplated by ASPR in ASPR 3-404.4.

For purposes of illustration, following is an example Fixed Price Incentive contract with successive targets as envisioned for this type procurement. All of the dollar values, percentages and ratios would be negotiable. However, typical values have been used in the example.

The initial R & D contract would contain a formula for determining the elements of a Fixed Price Incentive firm contract upon completion of the R & D phase using cost data accumulated during the R & D phase.

A typical example of the formula is as follows:

Initial Target Cost	$90M
Initial Target Profit	$10M
Minimum Profit	$ 3M
Maximum Profit	$17M
Final Ceiling Price	120% Final (Firm) Target Cost

ADDITIONAL CONDITIONS:

A. Minimum profit shall be reached at the point where costs equal 130% of initial target cost.

B. Maximum profit shall be reached at the point where costs equal 80% of initial target cost.

C. The formula for determining the firm target profit is displayed graphically in Graph No. 1 and is developed by joining points A, B, C, D and E by straight lines between the consecutive points. These points represent the following:

POINT

A. Maximum Profit ($17M) at all points below $72M cost

B. Maximum Profit ($17M) at 80% initial target cost

C. Initial target profit ($10M) at initial target cost ($90M)

D. Minimum profit ($3M) at 130% initial target cost (130% x $90M = $117M)

E. Minimum Profit ($3M) at all points above $117M cost

This series of interconnecting lines (AB, BC, CD and DE) represent graphically the formula for determining the firm target profit.

Upon completion of Phase 1 or at the point near completion of Phase 1 where the design and fabrication of the first system is sufficiently complete that the design is frozen and it is proven that the design meets all specifications, then the cost of Phase 11 is reestimated using the historical cost data from Phase 1 plus new vendor quotes for materials and subcontracts and a firm target cost for Phase 11 is negotiated.

By going to the Graph (Graph No. 1) the firm target profit is determined by locating the firm target cost and picking the point where the firm target cost intersects the profit line.

For example:

If Firm Target Cost Is:	Firm Target Profit Is:
$130M	$ 3M
$105M	$ 6.1M
$ 90M	$10M
$ 70M	$17M

Although the formula for determining firm target profit has been shown graphically, it can also be calculated mathematically. The slopes of the lines BC and CD are equivalent to share ratios and can be calculated as follows:

$$\text{The Slope of BC} = \frac{\text{Maximum Profit - Target Profit}}{\text{Initial Target Cost - 80\% Initial Target Cost}}$$

$$\text{Slope of BC} = \frac{\$17M - \$10M}{\$90M - \$72M} = \frac{\$\ 7M}{\$18M} = .39$$

This is the same as a 61/39 share ratio where the contractor's share is 39.

$$\text{The Slope of CD} = \frac{\text{Initial Target Profit - Minimum Profit}}{\text{130\% Initial Target Cost - Initial Target Cost}}$$

$$\text{Slope of CD} = \frac{\$10M - \$3M}{\$117M - \$90M} = \frac{\$\ 7M}{\$27M} = .26$$

This is the same as a 74/26 share ratio where the contractor's share is 26.

The firm target profit can therefore be calculated mathematically as follows:

Firm Target Profit = Initial Target Profit + (Initial Target Cost - Firm Target Cost) Contractor's Share

If Firm Target Cost equals $105M, then Firm Target Profit = $10M + ($90M - $104M) .26 = $6.1M

If Firm Target Cost equals $80M, then Firm Target Profit = $10M + ($90M - $80M) .39 = $13.9M

During the initial contract negotiations, the share ratios which will be applicable to the final Phase 11 contract are negotiated and included as part of the initial contract.

Typical share ratios which might be negotiated are as follows:

1. If the Firm Target Cost is equal to or greater than 130% of Initial Target Cost, the share ratios are as follows:

   Overrun: 95/5 to ceiling
   Underrun: 100/0 down to 130% of initial target cost, then
   90/10 down to initial target cost, then
   80/20 below initial target cost

2. Firm Target Cost between Initial Target Cost and 130% of Initial Target Cost:

   Overrun: 90/10
   Underrun: 90/10 down to initial target cost, then
   80/20 below initial target cost

3. Firm Target Cost less than Initial Target Cost:

   Overrun: 80/20
   Underrun: 80/20

After completion of the negotiations of the Firm Target Cost, the final Fixed Price Incentive formula for Phase 11 can be structured.

Assuming that the Firm Target Cost is $110,000,000, the incentive formula will be as shown in Graph No. 2 and consists of the following as shown in Table I.

The dashed lines on Graph 2 represent the incentive formula for the final Fixed Price Incentive contract for Phase 11 and superseded the formula represented by the solid lines.

If desired, the Firm Target Cost and Profit for Phase 11 can be combined with the cost and profit on Phase 1 (if Phase 1 is FPI, CPIF or CPFF) and the final contract firm target cost and profit can cover both Phase 1 and Phase 11. For example:

Using Graph 2, the firm Phase 11 formula is as shown in Table 11.

Assume that Phase 1 was CPFF with an estimated cost of $10,000,000 and fixed fee of $800,000. Further assume that the final cost was $15,000,000. Phase 1 when added to the firm Phase 11 formula would give the results shown in Table 111.

If it is desired to break the contract into pieces to cover multi-year funds, this can also be accomplished by bidding the first year alone; by bidding the 1st and 2nd years together; by bidding the 1st, 2nd and 3rd together, etc.

Graphs 3 and 4 show two additional examples for two different firm target costs.

The Graphs are based on the following examples shown in Table IV.

To illustrate that this concept will discourage underestimation of initial target costs and discourage trying to inflate costs in Phase 1 to achieve a higher target cost in Phase II, let's look at two examples:

Example 1 - Suppose the original estimate to do the job was $110,000,000 but in order to get the job, the contractor bid an initial target cost of $90,000,000 realizing that the firm target would be based on Phase 1 actual cost data. Assume that Phase 1 actual costs showed that a firm target of $110,000,000 was reasonable for Phase II and that actual costs turned out to be $110,000,000. Based upon the above formula, the contractor's actual profit would be about $4,800,000 (see Graph No. 5 Point B). If he had originally bid an initial target cost of $110,000,000 his profit would have been $12,200,000 (Point A). Therefore, the underbid cost $7,400,000 in profit with no way of making it up since this is the total production requirement.

Example 2 - Assume an initial target cost of $90,000,000 with initial target profit, maximum profit, minimum profit and share ratios as in Graph No. 6, and suppose the Phase 1 costs show that the $90,000,000 is a good figure for production but in order to get a high ceiling in Phase II, the contractor pads his numbers and negotiates a firm target cost of $110,000,000. In this case, the profit based on a $90,000,000 actual cost would be about $6,800,000 (see Graph No. 6 Point A). If he had not padded his figures and used the $90,000,000 as a firm target, the profit would have been $10,000,000 (Point B) so he gave up $3,200,000 in profit to get a higher ceiling.

From these two examples, it can be seen that the contractor maximizes his profit when the firm target cost is less than the initial target cost. Competition in the initial procurement keeps the contractor from overbidding on the initial target cost. This approach, therefore, offers the contractor a powerful profit incentive: (1) To give his best true estimate of the initial target cost; (2) To find ways of reducing production costs through cost conscious engineering design; (3) Upon completion of Phase 1, to give his best true estimate of the firm target cost; and (4) Throughout Phase II to continue to find ways to reduce costs.

This approach also reduces the severe risk imposed by a straight Fixed Price contract on a program with R & D and inadequate cost data for bidding Fixed Price, and thereby permits many companies to bid who would otherwise be forced to withdraw from the competition.

TABLE I

Firm Target Cost:	$110,000,000
Firm Target Profit:	4,800,000
Ceiling (120% Firm Target Cost)	132,000,000
Share Ratios: Overrun	90/10 to Ceiling
Underrun	90/10 to $90,000,000
	80/20 under $90,000,000

TABLE II

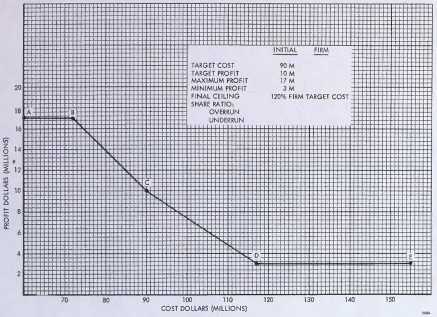
Firm Target Cost	$110,000,000
Firm Target Profit	$ 4,800,000
Final Ceiling	120% Firm Target Cost ($132M)
Share Ratios: Overrun	90/10 to Ceiling
Underrun	90/10 to $90M
	80/20 under $90M

TABLE III

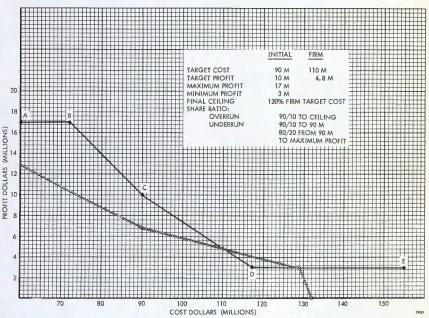
	Firm Phase II	Change	Combined Phase I & II
Firm Target Cost	$110M	Add $15M (Phase I Cost)	$125M
Firm Target Profit	$4.8M	Add $.8M (Phase I Fee)	$5.6M
Final Ceiling	$132M	Add $15.8M (Phase I Cost & Fee)	$147.8M
Share Ratio:			
Overrun	90/10 to Ceiling	None	90/10 to Ceiling
Underrun	90/10 to $90M	Add $15M to Limit (Phase I Cost)	90/10 to $105M
	80/20 under $90M	Add $15M to Limit (Phase I Cost)	80/20 to $105M

TABLE IV

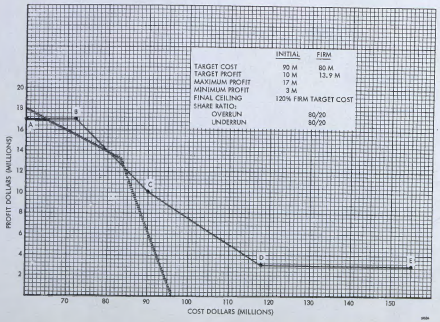
	Graph 3	Graph 4
Firm Target Cost	$80M	$117M
Firm Target Profit	$13.9M	$ 3M
Ceiling	$96M	$140M
Share Ratios: Overrun	80/20	95/5 to Ceiling
Underrun	80/20	90/10 to $90M
		80/20 under $90M



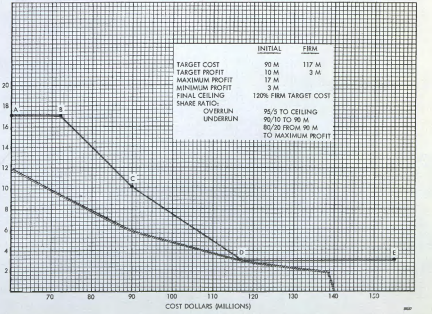
FIXED PRICE SUCCESSIVE TARGETS
GRAPH NO. 1



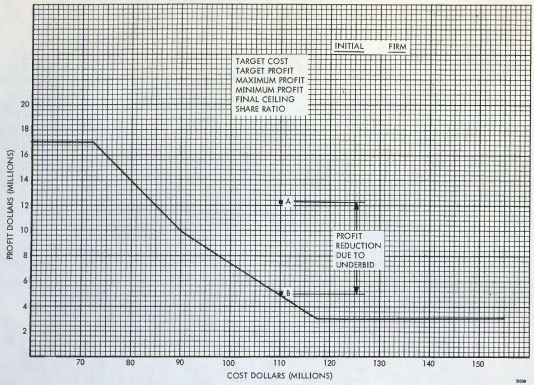
FIXED PRICE SUCCESSIVE TARGETS
GRAPH NO. 2



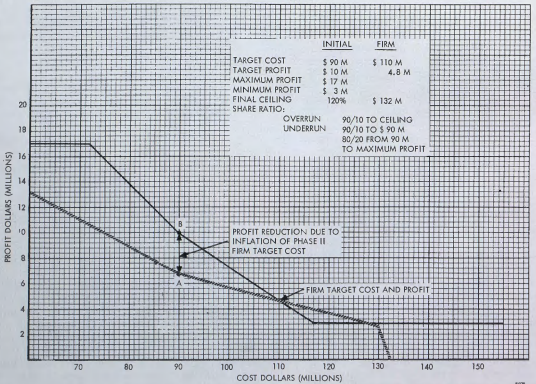
FIXED PRICE SUCCESSIVE TARGETS
GRAPH NO. 3



FIXED PRICE SUCCESSIVE TARGETS
GRAPH NO. 4



FIXED PRICE SUCCESSIVE TARGETS
GRAPH 5



FIXED PRICE SUCCESSIVE TARGETS
GRAPH NO. 6