DEFENSE SYSTEMS MANAGEMENT SCHOOL

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

POTENTIAL ADVERSE EFFECTS
OF COMPETITIVE PROTOTYPE VALIDATION

STUDY PROJECT REPORT
PMC 74-2

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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE:

Potential Adverse Effects of Competitive Prototype Validation

STUDY PROJECT GOALS:

To determine if in competitive prototype validation the contractor is motivated to disregard target cost to get increased performance believing that such a strategy will win the full scale development contract. If the contractors are motivated to disregard target cost, what can the PM office do to minimize the effects?

STUDY REPORT ABSTRACT

The purpose of this study seeks to determine if competitive prototype development under cost-plus incentive fee contracts might also include increased cost growth and goldplating potential. Interviews with procurement experts and project managers were conducted to determine if they felt there was basis for this concern; what could a project manager who finds himself in this situation do to keep goldplating and cost growth to a minimum; and what is the best type contract for the government to use in competitive prototype validation. The interviews confirmed that a cost incentive fee was ineffective in competitive prototype validation and that the competitive aspect of this situation could increase the potential for cost growth and goldplating. The conclusions are that competitive development can result in increased cost growth and goldplating potential. There is no one best type of contract for use in all competitive prototype development programs. This report contains a set of questions is included in this report, the answers to which should help serve to assist in selecting the best contract type for a specific competitive prototype program.

The key to whether or not competitive prototyping is a boon or a trap, or whether the design-to-cost concept will work in the future, is the government's demonstration, through its source selection decisions, that it truly considers development cost and design-to-cost efforts to be dominant criteria in source selection.

KEY WORDS

MATERIEL ACQUISITION PROTOTYPES INCENTIVE CONTRACTS COST GROWTH

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POTENTIAL ADVERSE EFFECTS OF COMPETITIVE PROTOTYPE VALIDATION

Study Project Report

Individual Study Program

Defense Systems Management School

Program Management Course

Class 74-2

by

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EXECUTIVE SUMMARY

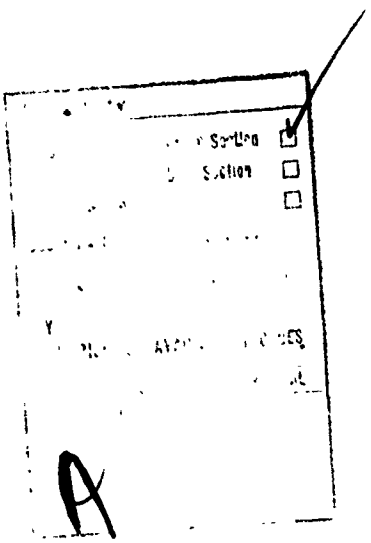
During a visit to the Defense Systems Management School in September 1974, General Henry Miley, Commander, US Army Materiel Command, expressed concern that competitive prototype development under cost-plus incentive fee contracts might also include increased potential for cost growth and goldplating. The thesis is that the prime motivator for the contractors is to win the follow-on contract. This dominant motivator then renders the cost incentive fee ineffective in that the contractor will spend whatever he feels is necessary to win. The competitive aspect of this situation might also lead the contractors to add a little goldplating to their product if they perceive it will give them an edge over their competition at source selection for the follow-on contract.

Research of existing literature revealed no discussion of these potential disadvantages of competitive prototype development. Interviews with procurement experts and project managers were conducted to determine if they felt there was basis for this concern, what could a project manager who finds himself in this situation do to keep goldplating and cost growth to a minimum and what is the best type contract for the government to use in competitive prototype validation.

The interviews confirmed that a cost incentive fee was ineffective in competitive prototype validation and that the competitive aspect of this situation could increase the potential for cost growth and goldplating. There was divergence of opinions on what steps the project manager faced with this situation could take and on what type of contract was best for the government.

The conclusions are that General Miley has identified an additional, potentially very costly, disadvantage to competitive prototype development. This is not to say that this type of development is not useful. On the contrary, being aware of the pitfalls will enable the government to practice the concept of competitive prototype development to its greater advantage. This study shows that there is no one best type of contract for use in all competitive prototype development programs. The best contract is one which has been tailored to the specific situation. A set of questions is included in this report, the answers to which should serve to assist in selecting the best contract type for a specific competitive prototype program. The ability to answer these questions accurately, and hence select a best contract type is heavily dependent on detailed knowledge of the contractor and his objectives.

The key to whether or not competitive prototyping is a boon or a trap, or whether the design-to-cost concept will work in the future, is the government's demonstration through its source selection decisions that it truly considers development cost and design-to-cost efforts to be dominant criteria in source selection.



ACKNOWLEDGEMENTS

I would like to extend my appreciation to General Henry A. Miley, Major General Robert J. Baer and all the others who took time from extremely busy schedules to share their ideas on this subject. I would also like to thank Mr. Albert E. Moore, Defense Systems Management School, for his advice and assistance in preparing this paper.

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INTRODUCTION AND PURPOSE

While lecturing at the Defense Systems Management School in September 1974, General Henry A. Miley, Commanding General, US Army Materiel Command, expressed concern about the interaction of various innovations in the materiel acquisition process. He described a situation in which the government had awarded cost-plus-incentive-fee (CPIF) contracts with two contractors to build prototypes in the validation phase. Upon completion of the prototypes, they would be tested against identical criteria (a "shootoff" of sorts) and then one contractor would be selected to enter the full scale development (FSD) phase based on test results in addition to other common source selection criteria. I will refer to this process as competitive prototype validation. The general's first concern was that the competitive aspect might negate the cost incentive in that the motivation to develop a product that would win the FSD contract would be so dominant that the validation contract cost incentives would have little or no importance. His second concern was that the competitive aspect might also have an adverse effect on the contractor's approach to design-to-cost. It is not inconceivable that a contractor could be motivated to go over on the design-to-unit cost goals, rationalizing that the resultant performance improvement will give him an advantage in source selection that will more than offset his competitors advantage of lower projected unit production cost.

If there is a basis for his concern, he has identified some potential serious adverse effects of competitive prototype validation. Until now, the only identified serious disadvantage of competitive prototype

validation has been the expense of supporting more than one contractor.

My purpose is to investigate the validity of these concerns, to identify the pitfalls involved in this type of situation and hopefully to develop methods of avoiding these pitfalls.

The questions I have tried to answer are all in the context of a weapons system acquisition situation where the government has fostered competition in the validation phase by awarding contracts to two or more contractors, only one of which will be selected to continue into the FSD phase. The questions are:

1. If the validation contracts are CPIF, does the competitive aspect of the situation negate the effect of the cost incentive and hence increase the likelihood of cost growth?

2. Does the competitive aspect increase the likelihood of the contractor goldplating his product?

3. What can the program manager do to prevent goldplating and prevent or reduce cost growth?

4. Is CPIF the best type of contract for the government in a situation like this? Is there a best type?

This study is limited in scope to the situation described above as it is faced by the US Army. However, even though the conclusions drawn are primarily the result of interviews conducted with Army personnel, the situation and methods of dealing with it have some commonality throughout the Department of Defense.

REVIEW OF RELATED RESEARCH

Numerous references on the materiel acquisition process make reference to competitive prototype development and to the benefits to be derived, but nothing could be found concerning the potential disadvantage under study in this paper. The only disadvantage identified in the references was the additional cost of sponsoring two or more contractors in the early program stages. The following quote from a Logistics Management Insitute Study, although short, is one of the more comprehensive discussions of competitive parallel development that could be found.

> "... is for the service to sponsor competition until competing designs are developed to the point where fixed-price contracts can be entered into in a competitive environment for the balance of the program. This approach is called parallel development. Two or more contractors are sponsored until the service can make a selection among competing designs and prices in a competitive environment. Parallel development is carried on until three conditions are satisfied. First, the contractors must know enough about their designs to assess accurately the risk they would be embracing in proposing to complete the program on a fixed-price basis. Second, the service must know enough about the designs to select the best alternative, price and all other factors considered. Third, the service must be able to assess the risk being assumed by the contractors and independently determine that it is reasonable for the contractors to assume that degree of risk.
>
> Sponsoring two or more contractors for parallel development is going to cost more in the early program stages. The cost of competing on that basis is usually too large for a company to undertake unless the government sponsors and pays for it. The additional expense may be recouped by obtaining lower prices in the later program phases than would be obtained in the absence of competition. Another benefit is the added assurance of a successful program because of the reduced risk implicit in parallel efforts. Competition can be sponsored at the system contractor level, among major subsystem elements or at both levels. Whether it is advantageous to sponsor competition, and at what level of system work breakdown structure are mostly matters of judgment. The decision - whether the benefits are worth the added cost of development - must turn on the facts in the specific program:

- The relative costs of development and production

  The development costs to the point of a sound basis for contractor selection must be compared to the costs of anticipated production. If the development costs are relatively low, competition in development looking toward competitive pricing of production is more advantageous than it would be if development costs are relatively large.

- The pricing environment.

  If the item is one for which there is a substantial pricing history and there is confidence in the accuracy of cost estimates, competition is not needed as much as it is if the government would be dependent on contractor cost estimates for production.

- The technical, schedule, and cost risks.

  If the risk of failure is relatively large and the consequences costly, parallel development is advantageous as a planned reduction of risk.

To highlight the range of problems associated with competition and type of contract, we might suppose a situation where competition can be obtained, and a contract can be written holding the contractor to a high level of required performance on a fixed-price contract basis. It may seem that the program manager need not concern himself with questions about the reasonableness of these arrangements. After all, no one is forcing contractors to commit themselves. They could refuse to bid. The winning bidder should be assumed to know what he is doing. We must not lose sight of the fact, however, that successful completion of the work is the main objective - and costs or price is only one aspect of the program. A contractor may yield to the government's superior bargaining position and agree to a high risk development effort on a tight fixed-price basis because it may be 'the only game in town.' If the result of the arrangement were, in fact, to bankrupt the company before it had completed the work, the program manager would still have the same problem he started with - the problem of completing the development and production of an operational system. In addition, he would have acquired another problem - a schedule bind." (13:22)

The contribution of this study is to enable the program manager to apply the concept of parallel development with greater advantage to the government, by pointing out additional pitfalls to be avoided and by developing a set of considerations that will assist in selecting a proper contract type.

RESEARCH METHOD

There is very little written on the adverse aspects of competitive prototype development. I have read all the references I could find on this subject plus a number of references on the concept of design-to-cost.

Since there is such a dearth of literature on this subject, the best source of information was the persons charged with materiel acquisition responsibilities in the U.S. Army. The possibility of using questionnaires to conduct a survey was considered and rejected. The subjects to be addressed were broad enough and philosophical to a degree that the specificity inherent in questionnaires might preclude the collection of some very pertinent information. The author decided that the best method of collecting information on this subject was by personal interview with knowledgeable persons.

The persons selected for interview were from those directly involved with procurement and procurement policy in Department of the Army and from those program management personnel with direct experience with programs that have competitive prototype development in the validation phase. The interviews were conducted face-to-face in most cases, however, due to the constraints on time and money for travel, some of the interviews were conducted via telephone.

The interviews with procurement and procurement policy personnel were conducted as follows:

1. The interviewer related General Miley's concern about the interaction of various current innovations in the materiel acquisition process as he had expressed it at DSMS in September 1974.

2. The author then specified a situation where the Army had let CPIF contracts with more than one contractor for parallel development in the validation phase, where only one contractor could be selected to continue into FSD. The interviewees were asked the following questions:

a. Does the motivation to win the FSD contract negate the contract incentive on cost and increase the likelihood of cost growth?

b. Does the competitive aspect of this situation increase the likelihood of goldplating?

c. What can a program manager in this situation do to prevent goldplating and cost growth?

d. What would be a better type of contract for the government to use in this situation?

e. What other steps can we take to alleviate the problem of cost growth and goldplating in parallel competitive development?

The interviews with program management personnel were conducted in a similar manner except that having confirmed that the specific program was currently in or had been in competitive parallel development in the validation phase, the above questions were put into context with the program experience prior to being asked.

Names of persons interviewed are in the bibliography. The objective of interviewing General Miley was twofold. First, it was necessary to obtain his permission to quote his remarks at DSMS because of the school's non-attribution policy pertaining to guest lecturers. Second, and more obvious, his considerable personal experience in materiel acquisition is a source of knowledge and philosophy that the serious

student in this field could hardly voluntarily overlook. The procurement analysts from the Office of Assistant Secretary of the Army for Installation and Logistics and the procurement policy personnel from Army Materiel Command were interviewed as active experts in procurement and contracting. The interviews with program management personnel were conducted to benefit from their personal experience with the situation under study.

This type of information gathering does not lend itself to rigorous data analysis methods. My method of analysis will be to examine the philosophies, experiences and recommendations expressed by the interviewees and to draw appropriate conclusions regarding steps that the Army could take to reduce the adverse effects of competitive prototype validation.

DISCUSSION AND FINDINGS

If the validation contracts are CPIF, does the competitive aspect of the situation negate the effect of the cost incentive and hence increase the likelihood of cost growth?

Without exception, the persons interviewed felt that the competitive aspect of the situation negated the effect of the cost incentive. They also agreed that the likelihood of a cost growth was thereby increased. There was not unanimous agreement on the severity of this situation. The policy makers tended to agree that it was a severe problem. Most of the program managers who had experienced cost overruns in a similar situation also agreed that the potential for cost growth was severely effected. The XM1 Tank System Project Management Office recognized the problem but expressed the opinion that their contractors were strongly motivated to treat their CPIF contracts as if they were fixed price. The cancellation of the MBT-70 program is considered an adequate message to the contractors that costs must be kept reasonable. Notwithstanding the XM1 offices qualification, it is fair to state that all interviewees agree that there is a real basis for General Miley's concern regarding cost growth in programs using the concept of competitive prototype validation.

Does the competitive aspect increase the likelihood of the contractor goldplating his product? This question usually resulted in the return question: "Why would it?" The interviewer would then explain that the contractor in a competitive situation might be disposed to opt for improved technical performance at the expense of design-to-cost goals and ceilings, since there are no real contractual teeth in our design-to-cost implementation. The only real teeth in this system will be the degree of importance that the Army's source selection process assigns to the consideration of each design's potential for meeting Design to Unit Production Cost (DTUPC) goals. Most of those interviewed gave the impression that they hadn't previously given much thought to this possibility. In general, they did not think we had a severe problem in this area. I attribute this attitude to two factors. First of all, we don't have enough experience with this situation to draw conclusions about the contractor's motivation to hold within DTUPC goals and ceilings. Second, the contractor's attitude is going to depend to a great degree on his perception of how serious the Army is about the potential of his design for meeting DTUPC goals being a dominant consideration in source selection for FSD. We have yet to prove our sincerity in this regard. I believe that there is real cause for concern here and that we must take steps to convince contractors that goldplating will lose the follow-on contract.

What can the program manager do to prevent goldplating and prevent or reduce cost growth? The first obvious choice is to threaten to terminate the contract under the 1966 Limitation of Funds Act (5:7:168). The effectiveness of this choice will depend to a great degree on the contractor's ability to continue without additional funding and on his perception of the government's real intentions regarding termination.

One of the procurement policy makers suggested a unique solution. He suggests that when a contractor projects that his costs will take him to minimum fee on the CPIF contract, and he will need to spend considerably more, then we should negotiate a new contract with him to provide additional funds on a cost share basis. For example, get the contractor to share costs on a 20% basis above a specified figure. This method may not prevent cost growth, but it certainly appears that it would keep the size of the growth to a minimum. One of the project managers of a less-than-major program had a similar solution. When his competing contractors had overrun their cost reimbursable type contracts, the government negotiated Firm Fixed Price (FFP) contracts to complete the validation phase. This would eliminate further cost growth, but it would also severely constrain the government's participation in the remaining validation development effort. Another project manager said that his program kept validation costs down by insisting that the contractors adhere to every detail in the schedule. This method has a major drawback in my opinion. That is that the project manager sacrifices one dimension of his flexibility, reducing his ability to make logical trade-offs. The indiscriminant adherence to every detail in the schedule, in the absence of a perfect plan, could easily degrade technical

performance and prevent unit production cost and life cycle cost savings that might result from careful trade-offs.

> "The program manager and the user must continually balance program funds, schedules, and the desired characteristics of subsystem performance." (13:10) (underlining is the authors.)

A number of the persons interviewed suggested that one method of minimizing cost growth was to appeal to the hierarchy when projected growth seemed unreasonable. Admonishments of corporate presidents by high ranking government officials would serve to add credibility to the government's determination to place dominant emphasis on cost, (both development and DTUPC goals), in the source selection process. This demonstration of commitment may be necessary until we have proven by our source selection actions that we mean business.

The XM1 Tank System project under Major General Robert Baer has had success to date in keeping cost within budget. He attributes his success in part to a clear and firm government policy and an exceptionally good communication between contractor and government. A part of the clarity he refers to can be attributed to the fact that both General Abrams and Secretary Calloway advised the contractor corporate presidents at contract negotiations that they would be expected to treat their CPIF contracts as fixed price. The program office feels that

> "The competitive prototype concept has worked well as an incentive to both contractors. They consider a 'winner' to be important for their corporate image as well as for the financial payoff. The contracts have incentive fee for below target completion but this is overshadowed by the competition incentive. In the final evaluations that take place in 1976, they both know that management efficiency will be an important consideration in both establishing basis for an FSD program and selecting a contractor therfore. The management of dollars being the most important factors in this determination." (22:2)

The XM1 Project Manager's approach to the problem then is to foster an atmosphere of mutual trust and total honesty in financial matters with the contractors. He feels that

> "Our success or failure will be mostly determined by our success in maintaining a dedicated contractor effort and an open, responsive, and candid communication link between my staff and the contractors." (22:3)

Is CPIF the best type of contract for the government in a situation like this? Is there a best type?

All but two of those interviewed felt that CPIF was not the best type of contract for the government in a situation like this. One of those two, an official at the policy making level, suggested a CPIF contract with the share line going to zero fee, then followed by a cost share line so that the contractor absorbs a portion of all costs above a specified figure. The contract could be written with a myriad of interesting variations. For example, the cost sharing could be on a constant basis, say 50/50, or the cost sharing could begin at 20/80 at the zero fee point, continue at that rate until costs reach some specified higher figure and then change to 50/50.

The number of changes in cost share ratio need not be limited to just one. Some examples of possible share lines are shown in figure 1 and figure 2. The one project manager who felt that CPIF was the best, agreed that the incentive fee was not a real motivating factor but that a cost incentive fee was better than some type of fixed fee because if the cost growth was going to occur anyhow at least the government has saved some money by the reduced fee. About a third of those interviewed felt that a Cost Plus Fixed Fee (CPFF) would be better. Their rationale was: why have an incentive line if we know the incentive is ineffective? They argue that the best way to keep development costs and goldplating down is by convincing contractors that these elements will be dominant considerations in source selection for the FSD contract. A few of the interviewees felt that some form of Fixed Price contract might be appropriate. One felt that if the technical risks were low an FFP

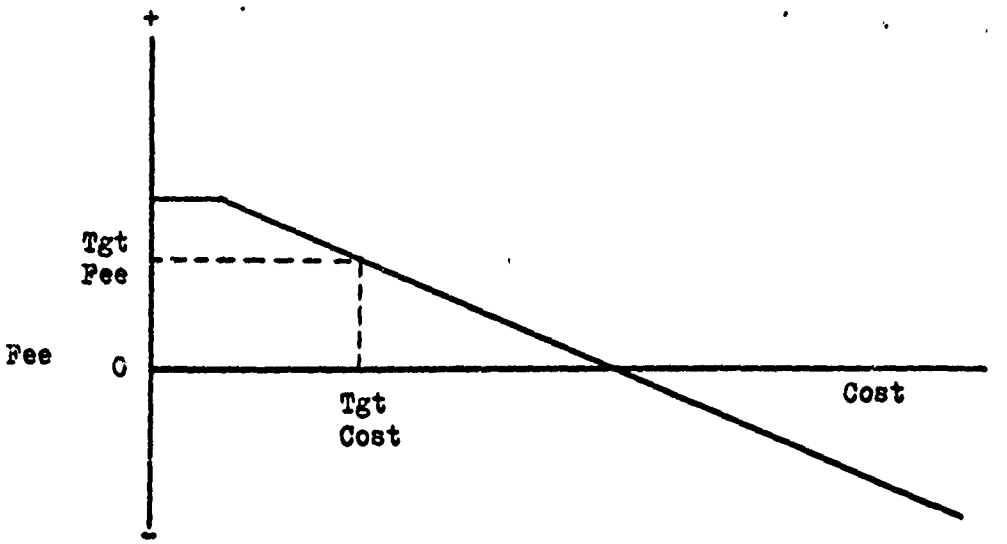

Fig. 1. Sample Fee and Cost Share Scheme

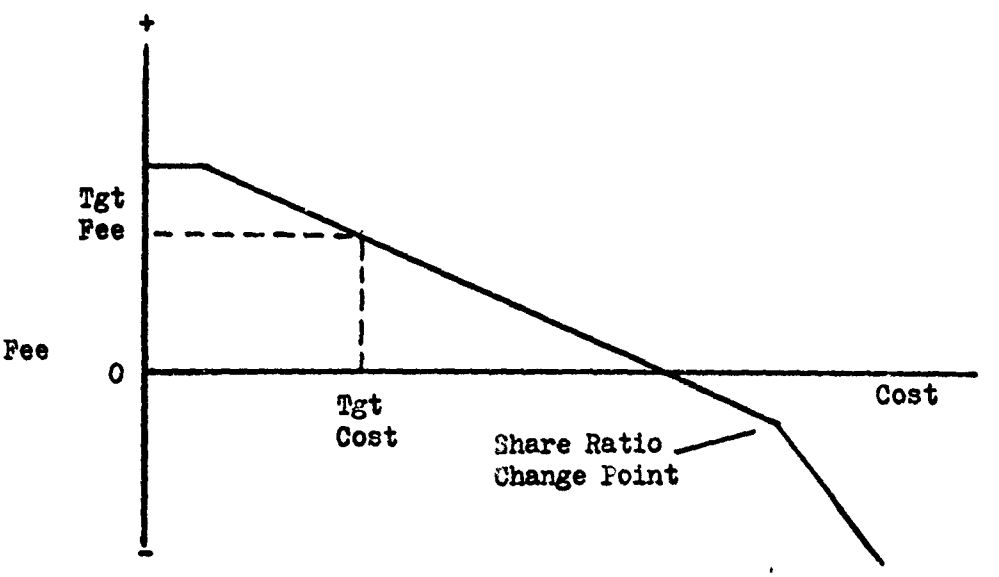

Fig. 2. Sample Fee and Cost Share Scheme

contract would be the best. Others felt that some form of Fixed Price Incentive Fee (FPIF) contract would be best.

One point emerges clearly from these interviews. That is that there is certainly no consensus as to a best type contract for the government in this situation. Clearly, the contract must be tailored to fit each specific program. Further, there is no "cookbook" formula for selecting the best type contract. Some discussion though of the advantages and disadvantages of various type contracts is in order. An FFP contract should not be ruled out simply because the risk to the contractor is high. In certain circumstances the contractor may be willing to accept that risk for a chance to win follow-on contracts. Sure, the winner will probably get his validation costs back later on, but we may have gotten the loser's validation efforts at a lower cost than otherwise. One major disadvantage to an FFP contract is that it practically eliminates any further government participation in the validation development and reduces cost visibility. Another potential pitfall in an FFP contract is the degree of the contractor's asset commitment to that effort. We should have no desire to bankrupt a contractor. Further, a contractor who goes bankrupt prior to completing the validation contract could leave us in a sole source situation. There are a number of potential pitfalls in the use of FFP contracts for competitive prototype validation but they should be considered if the pitfalls are identified and appear to be easily avoidable. The disadvantages of Fixed Price Incentive Fee (FPIF) are similar to those of the FFP type with reduced severity. We have increased visibility of costs, since Cost/Schedule Control Systems Criteria (C/SCSC) is a requirement for selected major defence systems with FPIF or cost

reimbursable type contracts, whereas programs with FFP contracts are excluded from C/SCSC coverage. However, even though C/SCSC is applicable, the fixed price type contract constrains government participation in the development.

Cost reimbursable type contracts appear to be the logical choice for most validation phase contracts. We must give the contractor cost flexibility to make trade-offs during this phase.

> "Cost type contracts should be used to the maximum extent possible during the concept definition and development phases. Fixed price contracts motivate against good trade-off analyses and the associated changes in program direction and emphasis." (17:2)

It would also seem logical that when we believe that we can estimate cost within a reasonable range that a cost incentive fee would be appropriate. This is, of course, only true if the contractor is actually motivated by the incentive. We have shown that the real motivator with competitive prototype validation is the follow-on FSD contract. If the contractor believes that he can win the FSD contract with high technical performance at the expense of contract cost growth and DTUPC growth, then the cost incentive fee and the follow-on contract motivator are incompatible, with the follow-on contract motivator dominant. However, if the contractor is convinced that his demonstrated cost management ability during the validation phase will be a <u>dominant</u> criteria for selection of the FSD contractor, then the incompatibility is eliminated and the contractor can work to hold development cost and projected unit production cost down, knowing that he is at the same time improving his chances of winning the FSD contract.

There seems to be a trend towards the use of award fee provisions in cost contracts. The award fee concept requires considerable additional administrative effort, so we should be sure that the extra effort will result in sufficient improved contractor performance before making this choice. A number of the interviewees recommended Cost Plus Award Fee (CPAF) contracts for the follow-on FSD contract, with the award based mainly on cost management and the quality of the contractor's design-to-cost efforts. None of the persons interviewed recommended CPAF contracts for competitive prototype validation. Perhaps an award fee for cost management and design-to-cost efforts would provide additional emphasis on cost reduction until our source selection system has proven to industry by its actions that management of cost is truly a dominant criteria for selection.

SUMMARY AND CONCLUSIONS

According to the June 1972 Research and Engineering Advisory Committee (REAC) of the National Security Industrial Association report titled, "Design to a Price Study," the advantages of competitive development are:

> "1. It permits final selection for production to be made when the facts are really known thus reducing the skill required in proposal evaluation.
>
> 2. It eliminates or at least substantially reduces the motivation for contractors to buy-in in the development phase because of the lack of assurance of winning the production follow-on.
>
> 3. It provides strong motivation during development to achieve the lowest possible production price." (17:2)

I believe this third listed advantage is valid only if the contractors are convinced that projected unit production cost will be a dominant criteria in source selection for FSD. The only reference to any disadvantage of competitive development that the REAC report makes is by implication only in the statement:

> "Preferably two contractors should be continued through development unless the particular systems is so large and the number to be produced so small that the cost of continuing competition through this phase is considered unwarranted." (17:2)

In my opinion, General Miley has identified an additional, extremely dangerous disadvantage. That is, that the competitive aspects of the situation may actually drive the contractor toward cost growth and/or goldplating in some instances. I am not saying that competitive prototype programs never achieve the above listed advantages, for there is ample evidence that some programs have used this concept with a high degree of success.

"The merits of competition can be exemplified by the benifits realized in two competitive prototype programs, the Airborne Warning and Control System (AWACS) Program and the A-X Close Air Support Aircraft.

In stating the effects of competing with Hughes on the AWACS Program, the Boeing Company stated:

> 'Without the stimulus of the competitive environment, we feel it would have been impossible to motivate either contractor to the level achieved ... Program estimates range up to 100 million more dollars for 25% less performance if we had gone with only one radar contractor.'

Competition also played a major role in the A-X prototype development. Colonel James E. Hildebrandt, A-10 program director, has stated:

> 'There is no question in my mind that the (Fairchild) A-10 would cost more ... if it hadn't had competition from the (Northrop) A-9. I am quite sure Fairchild would have gone more for optomizing performance if it hadn't had competition to hold the cost down.'" (12:71)

The key to these successes is that the contractors really believed that they had to hold cost down to win the follow-on contract. Colonel Wayne F. Frye, USAF, in an article published in the Defense Management Journal about the A-X program stated:

> "The validity of the contractors' proposals for the design-to-cost goal and the support cost model were key factors in the source selection review." (7:32)

The complexity of the question of contractor motivation was highlighted in an article titled, "Air Force Evaluating Acquisition Costs," published in the July 15, 1974 issue of Aviation Week and Space Technology.

> "What really motivates contractors as opposed to what theoretically should motivate them has been a debated question. One study concluded that, contrary to economic theory, aerospace contractors were not fundamentally profit motivated. Instead, the argument ran, they were sales motivated, in keeping with preservation of competitive engineering and manufacturing teams and in delivering performance.

> Another study found that contracts with large contractor cost sharing rates tended to overrun, contradicting the theory that greater risk by contractors would act to reduce costs. This study also found that cost-plus-incentive-fee contracts had greater overrun than cost-plus-fixed-price or fixed-fee contracts." (1:29)

The above serves to support the point of view that there is no simple solution to the problem of selecting the correct type contract. My conclusion is that each separate competitive prototype development situation is unique, and the contract type must be tailored to the specific situation. Too many times in the past we have fallen prey to fads, as evidenced by the preponderant use of CPIF contracts for competitive prototyping by the Army. We have also been guilty of a dogmatic approach as demonstrated by the statement of a retired service secretary that all contracts written for competitive prototype situations should be firm fixed price.

I don't believe it is possible to devise a meaningful systematic method of selecting the best contract type, but the process of developing answers to the following questions should serve as an assist in making the decision:

1. What is the contractor's dominant motivating factor on this program? Is it to win the follow-on contract? Is it to make profit on this contract? Is it to improve his expertise in this field at government expense?

2. To what degree do you want to participate in the development effort? Remember, FFP type contract leaves you out.

3. To what degree do you require C/SCSC data? FFP is excluded from C/SCSC.

4. Is the contractor motivated enough by potential follow-on business to put some of his own money into this development? Can he afford to? What is the probability of him going bankrupt prior to completion?

5. What is his potential for sloughing off some of the excess costs on this program to other government contracts?

6. To what degree does he believe that the government really will place dominant emphasis on cost performance and potential accuracy of his design-to-cost estimates during source selection?

7. Can we depend on him to perform all necessary design-to-cost trade-off analyses if he is not on a cost reimbursable contract?

8. How much confidence do you have in your estimate of development costs?

The answers to these questions will come hard, and in varying degrees of accuracy in each situation. It is my contention that these questions must be answered in order to make an intelligent selection of contract types. It is easy to see that one set of answers could lead to the selection of a firm fixed price contract where another would lead to selecting cost plus incentive fee. The possibilities, of course, include all the variations between these two extremes. It follows that our ability to answer these questions accurately, and hence select the best contract type, is heavily dependent upon how well we know the contractor. We've got to know as much as possible about each contractor's objectives. Extensive effort in the selection of contract type will be paid back many times over in ease of contract administration and prevention of cost growth.

There is no "cookbook" solution for the project manager to prevent or hold down cost growth and goldplating due to competition. He should do everything in his power to convince the contractors that goldplating and cost growth will be dominant negative criteria in source selection for the next phase. In the meantime, if the government's source selection actions support his arguments, then the convincing becomes easy. On the other hand, if a goldplated item, developed with an overrun wins a contract over a competitor who honestly designed-to-cost with a minimum contract cost growth, then the convincing may become impossible. The record of our source selection activities over the next few years will be the deciding factor on whether the design-to-cost concept will work in the future.

A study of programs that have completed competitive prototype validation phase, comparing cost growth with contract types could lead to some very useful conclusions. Such a study should include programs of all services, since each service currently tends to lean toward a specific type of contract. The study might consider the degree to which the contract type used differs from the type that would have been selected by applying the considerations developed in the conclusions of this study.

This study should be of interest to those involved in establishing procurement policy for the Army. Its conclusions might, when considered along with their extensive knowledge and experience, influence future guidance concerning contract type selection. It should also be of interest to program managers who are considering or already involved in competitive prototype development as it likely contains some ideas that they have not previously considered.

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