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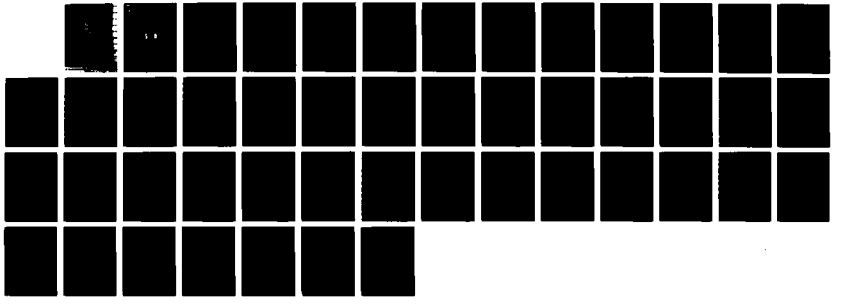

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BRMC-87-02

COMPETITION IN A NONCOMPETITIVE ENVIRONMENT

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May 1987

Final Report Ending May 1987

Prepared for
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FOREWORD

We often view competition as an attribute that is either present or not present in any particular procurement or program situation. In reality competition is a relative term. We can always have more competition or less competition. This paper reviews the literature on competition in Defense and tries to integrate the varied findings. In particular, it focuses on DOD attempts/approaches to increase competition and tries to indicate product, government, and contractor characteristics that lead toward certain competition enhancing approaches.

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COMPETITION IN A NONCOMPETITIVE ENVIRONMENT

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This paper deals with the attempts by the Department of Defense to instill competition in the DOD acquisition environment. The paper summarizes many of the theories, conclusions, findings, and opinions that are present in the literature. The major conclusions are that the government has both active and passive means for increasing competition; that when conditions are right, increased competition can result in better contractor performance based upon cost, schedule, and/or performance; but when conditions are wrong the desired results may not occur. Not all products or programs merit a competitive market.

1. Goals of Competition

Competition is thought of as a means of "bringing out the best" from a person or organization. For example, in a single elimination basketball tournament, many teams will play the best games of their season. They know that they must win now or never. In the business world it is widely assumed that industries with stiff competition are more efficient than industries with little competition. "Bringing out the best" and more efficiency are desirable,

but overly general goals. Specifically, what are the goals of competitions in DOD procurements? McCann (1986) cites economic, surge, and social-political reasons. Kidder (1985) cites reliability and schedule.

The acquisition of many DOD requirements, facilities and major weapons systems for example, can be thought of as projects. All projects seek to control three variables: cost, schedule, and performance. The goals of introducing procurement competition, for these type procurements, can be broken into cost goals, schedule goals, and performance goals. Some competitions are introduced to achieve one of these goals, some are staged to achieve multiple goals. The major goals of competition are usually thought of as either cost or schedule goals. Most studies that have attempted to assess the success of competition have only investigated the cost goals. This seems to be inadequate. For example, the GAO (1984b) stated "Price competition was not the primary objective of any DOD dual source procurement."

Cost goals of competition are most frequently cited. Cost goals are normally to lower the overall costs to the government. Sometimes this is intended to result in actual cost savings and sometimes it is merely intended to slow or contain cost growth. An additional cost goal of competition per Bell (1983) is that contractors accept more

financial responsibility for defect correction. This helps limit government liabilities in the future. In contrast, an AFALC contracting lesson learned indicates that DOD may not even be able to afford warranties when dealing with sole source suppliers. (Contracting Lesson Learned # 1381, Jan 87 Abstracts)

Schedule goals of competition are related to the assurance of an adequate supply of the item at the proper time and location. The General Accounting Office (GAO) (1984b) stated that if it appears one contractor may have difficulty in meeting the delivery schedule, dividing the procurement among contractors may make sense. Sometimes, however, it may take a second contractor so long to get started that it would be easier to meet the delivery schedule with only one contractor. Deets (1985) notes another aspect to meeting the delivery schedule is to smooth production fluctuations. Sometimes one contractor has enough overall capacity, but cannot deliver the necessary items in exactly the quantity, time, and location that is required. In this case, even though one contractor possesses enough overall capacity, it makes sense to use more than one contractor. A contractor may be able to deliver satisfactorily now, but appear to have trouble in the future. There could be possible labor disputes, interruption of supplies to the contractor, natural disasters, etc. While the government does not wish

to take sides in disputes, national defense requires uninterrupted supplies of military necessities. If there appears to be reason to doubt the assurance of this supply in the future, it is the responsibility of the contracting officer to take whatever actions are necessary to continue the supply. The judgement that a contractor may face trouble delivering in the future is often difficult to make, but it is a judgement that must be made. To complicate matters, McCann (1986) reports that AFLC has experienced longer lead times on spare parts when breakout was used to increase competition.

In addition to schedule goals for the immediate procurement, there are long term schedule goals of competition. The number of defense contractors has shrunk considerably in recent years. Maintaining or increasing our mobilization base of contractors should be a long term goal of competition. This would allow us to better "surge" our military production should the need ever arise according to Beltramo (1983) and Kidder (1985). Finally, Deets (1985) indicates that if we should ever go to war, geographical dispersion of contractors would improve our ability to continue production of military goods.

The final category of competition goals is performance. These goals can be grouped into those that improve the current item and those that improve future

items. Kidder (1985) states that product performance can be enhanced by proper use of competition. If design competition is used, bad designs can be corrected. If quality is included as a goal of competition, improved quality assurance can result. Future items can be improved through competition by increased efforts in product development. Competition can be used to create major design innovations.

The possible goals or objectives of competition on a project are thus varied and interrelated. A balance of cost, schedule, and performance is always implied. With some thought the objectives of non-project competitions can be seen to also fit within these three categories.

2. Types of Markets

It should be noted that the market type determines the capability to accomplish competition. DOD and the Air Force (AF) face a variety of markets in different situations and must adjust their behavior and expectations of competition to the reality of the instant market; although certain attitudes and initiatives may affect the type of market over the long run. It is useful to consider some of them.

a. Perfect Competition: In many cases our requirements can be procured from a (nearly) perfectly competitive market. Examples include our needs for office supplies, provisions, and most commercially available equipment. In this type of market Mansfield (1982) indicates that no one buyer or seller can influence the price, output is homogeneous, resources are mobile, and knowledge of the market is perfect. Demong and Strayer (1981) rephrase and weaken these to: numerous buyers and sellers, a homogeneous commodity, entry and exit from the market can be accomplished in the long run, and perfect information about prevailing prices and bids is available. We are encouraged whenever possible to buy from this type market. If so, we need only assure that we don't levy unreasonable requirements on our buyers.

b. Monopoly: This is considered to be the worst situation for the buyer/user, the case of only one source. Examples include local purchase of electricity, perhaps procurement of a patented product, procurement of major weapons systems (after Milestone III), and spare parts for weapons systems in many cases. Commercial monopolies are often seen as so undesirable that they are precluded or broken up by law. The concern in DOD is that suppliers who find that they are the sole source of particular items could use this leverage to increase prices. This could be done for higher profits, or perhaps simply by not keeping

tight control over the costs of those items with a guaranteed buyer. One constraint on the monopolist in the commercial world is the ability of the user to substitute other products to accomplish the same end. For example, Mansfield (1982) cites that a monopolist steel supplier would be somewhat constrained on price by the presence of other structural material suppliers such as those for aluminum, plastics, or other substitutes.

c. Monopolistic Competition: This views each of many source's products as somewhat different from those from other sources, the products are not homogeneous. Products fall within general product groups. Each source attempts to differentiate their product as better in some way than those of their competitors. Examples would be colas and micro computers. Mansfield (1982) indicates that under monopolistic competition the firm can do three things to affect its rate of sales: change its price, change the characteristics of its product (its ability to differentiate), or change its advertising and promotional expenditures. Many companies can, by differentiation within the product groups through advertising, demand a higher market price. Our charge as DOD consumers in this type market is to identify the requirements, but not to over define them to the point where only one producer can satisfy them.

d. Oligopoly: Whenever there are only a few sources for a product, the market is called an oligopoly. Mansfield (1982) further indicates that there is a great deal of interdependence among these few sources. A source's policies and decisions are made with concern for their effect on their rivals. DOD often faces the situation of a differentiated oligopoly where products are not homogeneous or the case of a duopoly where there are two sources of a homogeneous product. Examples for differentiated oligopoly include most major weapons systems/subsystems; while a leader-follower program would result in a duopoly.

In addition to the four general market types described above we should consider the following as well:

e. Monopsony: The case of a single buyer and many/several sellers. DOD often finds itself in this type market when dealing for systems/subsystems to be designed and built specifically for U. S. forces use. Here the power lies with the single buyer. For example, companies will sometimes bid on less than desirable contracts because they are the "only game in town" if they plan to continue in defense business. Abuse of this power can result in a decreased base of industries willing to do business with DOD.

f. Bilateral Monopoly: Here the market is reduced to one source and one buyer. In this case the price and output depend upon bargaining power, negotiating skill, and to some extent public opinion. Examples include the USAF and Rockwell on the B-1B and DOD and McDonnell Douglas on the F-18.

Conclusion: It is thus clear that DOD enjoys many different markets with different potential levels of competition. Our behavior must certainly depend upon the type of market, we must procure weapons systems in a manner different from office supplies. It is noted by Demong and Strayer (1981) that almost all the conditions assumed for perfect competition are violated in the procurement of major weapons systems. Typically there is but one buyer and, quite early in the system's life cycle, only one source. The definition of competition in these cases is not that of the ideal perfect competition. Rather, Skantze (1986) and Grossman and Augustine (1986) reflect the DOD view that we need only two sources to have competition. While this is clearly necessary it is not sufficient since Beltramo (1983) indicates the sources must be not only able but willing to compete. As Toda (1984) indicated "competition is a perception." Without the perception that competition exists, it has no effect. McCann (1986) further elaborates that we need at least two independent suppliers with the technical competence, requisite

facilities, and willingness to satisfy the requirement. Given this definition of competition within DOD, the objective of competition can be seen as that of changing the market type from one inherently less competitive, to one inherently more competitive.

3. Actions that Improve Competition.

Ideally we would like to take action moving our market to one of a more competitive nature. Generally this means improving the market in terms of flow of information, number of customers, or number of sources.

a. Flow of Information. Recall that perfect competition requires "perfect" information. As this information is lessened, the uncertainties for the contractors increase. Increased uncertainties drive up the risk of doing business, which reduces the base of contractors willing to compete in our market. An A. D. Little study (undated) claims that industry looks not only at profit potential, but also at program length and cash flow before deciding to compete for defense business They indicate that if DOD would make planning documents available to industry, two effects would be:

(1) it would motivate contractors to enter the (DOD) market.

(2) if already in the market, it would allow them to produce a more astute business plan.

In addition, it has been noted by Casey and Williams (1986) that reduction of the administrative burden of bidding and source selection, thus shortening the feedback loop, can improve the level of competition. While totally perfect information flow will never be possible, improving the information flow in terms of content and speed are very positive actions which can be expected to improve the competitive nature of the DOD market over the long run.

b. Number of Customers. While we in DOD may not see our role as that of increasing the demand side of the market, it must be noted that this is a necessary part of a competitive market. Encouraging the use of systems, subsystems, components, or even technology of DOD systems in commercial applications will increase the size and competitiveness of our market. A larger market will increase the likelihood of market entry and thus, over the long run, increase the number of sources as well. The flip side of this is the attempt by DOD to use commercial items whenever available, an objective actively pursued by DOD.

c. Number of Sources. A direct attempt to increase the number of sources is seen as the fastest way to improve competition. This can be approached in a number of ways depending upon the type of item and the stage of the item's life cycle.

(1). Open to Non-US Sources. Recognizing the interdependence of the free world nations, one way to increase the number of sources is to open competition to non-US contractors. Contractors in Western Europe, Japan, Israel, and other industrialized countries could certainly compete on many of our procurements. Weapons systems and components developed and produced overseas and used by allied forces are certainly comparable in many cases to our own. There is no reason to believe that they could not design and develop items adequate for our needs.

While this approach would seem to serve us well as the customer, there are some cautions. An A. D. Little report (undated) indicates that threats to open to world wide suppliers could result in reduction of our own defense industry base. While it is clear that award of a contract to an allied country's source means it was not awarded to a US source, the Little report claims the threat itself weakens our support of the defense industry sector to the point where it could be disassembled. Their premise is that capital markets try to avoid uncertainty; that threats to buy from overseas competitors increase this uncertainty,

reducing the possibility of capital improvements in this sector and potentially forcing it to be disassembled. This is clearly a case where trade-offs are required. One approach might be to require the foreign contractor to produce some modest percent of the product in this country, thus assuring that we have the technology available if required. If standardization and interoperability are desired, wider markets seem desirable both for our US producers and for our sources.

(2). Consider weapon systems in groups. Meeker (1984) feels that competition would be enhanced if we would consider groups of weapon systems rather than individual weapon systems. His example deals with air to air missiles. Rather than require 1000 of type A, and 2000 of type B, why not say we need an air to air capability that can be satisfied through a variety of combinations. Trades on quantities can then be performed based upon the economics and performance of the competitors. Stating requirements in a more general manner thus automatically allows competition. These systems are then seen as substitutes for each other and rather than dealing with a monopolist, we have monopolistic competition among our sources. Meeker (1984) claims this should allow us to buy among these sources for the best overall combat capability, reducing the prices of all competitors. Of course the most

ineffective, most inefficient systems could be squeezed out of the market completely.

(3). Streamline Source Selection procedures. Casey and Williams (1986) related that a streamlined source selection procedure increased competition at the Air Force Systems Command Ballistic Missile Organization (BMO). They reduced the time needed to award contracts and the number of people involved in each source selection. As a result they were able to hold more source selections and provide more competition using existing resources.

(4). Assume more integration responsibility. Typically a weapons system contractor buys a significant number of items from subcontractors or suppliers. Product breakout occurs if these items are broken out of the prime contract, procured separately by the government, then provided as government furnished equipment (GFE) to the prime contractor. The procuring agency (DOD) thus assumes integration responsibility; i.e. that the item is properly built and will work properly. Per Sweeney and Insley (1985), the Air Force Systems Command program offices were directed to breakout non-complex, non-critical items where the prime contractor provides no value added. In one instance Sweeney and Insley indicated there was a 78% price reduction on such items when they were broken out. McCann (1986) indicated that two samples (one by AFLC and one by

Modern Technologies) on AFLC's breakout of spares resulted in mean savings of 16% and 29% respectively, with a return on investment of about 8 to 1 for the product breakout effort. Several non-price reflected costs need to be considered for breakout. McCann reports these as:

- cost of screening.
- cost of additional purchase requests.
- government overhead.
- additional contracting costs.
- field acquisition support.

These costs can be significant. Sweeney and Insley (1985) indicated that five people spent six months screening some 3300 items on the F-15 aircraft to identify 118 that could be efficiently broken out. McCann (1986) also reports that there is strong evidence of increased lead time due to breakout. The percentage of on time deliveries has dropped.

(5) Maintain or create two sources.

These can be grouped into those called dual sourcing and into those called second sourcing. Dual sourcing implies an active effort on the part of DOD to start and maintain competition throughout the system's life. Second sourcing implies creation of an alternative source for production, typically after the prime contractor has produced a number of units or several lots. This division, however, does not seem as useful as a break into passive and active

approaches. Passive approaches are those which make it easier to develop additional sources, even if such does not become necessary. They thus keep the possibility of competition at a reasonable cost alive. An example of a passive approach is the use of performance specifications rather than design specifications to enhance DOD competition, as recommended by a Don Sowle Associates report (1980). In contrast, active approaches require creation of the alternate source, and thus drive immediate costs up more substantially.

4. Passive techniques to increase competition:

Passive techniques include increasing information flow to the contractor, the use of more general specifications, the purchase of production data, and contractual provisions that force the contractor (at our option) to develop a second source.

a. Form, Fit, and Function (F^3). This technique assumes that the product desired can be adequately specified as to external characteristics, performance characteristics, and interoperational (interface) requirements. The Navy reportedly cut unit cost on a piece of A-6 avionics by 79% by using F^3 competition. They also reportedly received newer technology and saved $2.3 million on the buy. (Genovese, 1985).

(1) Deets (1985) claims the following additional attributes for F^3 competition:

(a) Can help the government get around the data rights problem.

(b) Since it is the contractor's design, they are responsible for its performance (versus other techniques where the second source may be trying to use designs from a prime contractor).

(c) Opens the possibility of continual design and production competition.

(d) Allows the contractor to design and produce an item that utilizes his strengths and is most efficient for him.

(e) Can be used to get other sources of supply when transfer of technology is not possible.

(f) Can be used to correct a bad initial design.

(2) To use the F^3 competition technique effectively, the decision should be made early in the system's life. The maintenance concept and design for the item can be significantly affected by the desire to use the technique. The maintenance concept for such items would probably lean more toward disposable items or contractor support. Organic maintenance for several variations of an item could rapidly become expensive. The possibility of

bringing in a second source is intended to motivate the prime to properly control costs or even propose later improved designs. If it becomes necessary to use this option and bring in a second source the additional cost categories include:

(a) R & D costs for the second contractor.

(b) Requalification.

(c) Administrative costs.

(d) Logistics support.

b. Detailed Design Disclosure/Technical Data Package. This approach requires the government buy the detailed data, and rights at the level needed to allow another qualified contractor to produce the same item. To do this economically and properly, this option must be inserted early in the acquisition life cycle.

(1) McCann and Ward (1985) cite four uses for such data packages:

(a) Competitive Acquisition of identical items (requires detailed/full design disclosure).

(b) Competitive Acquisition of interchangeable items (requires less data).

(c) Competitive Acquisition of items from selected sources.

(d) Noncompetitive (sole or directed source) acquisition.

(2) Hale (1985) relates several questions that will impact the desirability of using this option. One fact that must be assessed is the level of interest of the appropriate industry. Do they want to build an item of another's design, and at the quantities desired by the DOD? Do other companies have the technological ability to produce the item. Examples exist where the second source has been unable to master the technology needed. Are the performance requirements stable? If they change, the technical data package must be redone, driving up the costs of this option and making its economic justification less likely. Will adequate funds exist to procure the technical data package and rights to use the data? These are up front costs to essentially buy a competitive attitude now, with the possibility of more easily creating additional sources in the future.

c. Directed Licensing. Directed licensing is cited as a means for establishing production competition by many sources including Beltramo (1983), Williams, Williams, and Bradley (1983), and Kidder (1985). It involves inserting a clause in the early development contract which allows the government to select a second firm as a licensee, if desired by the government. The original contractor

provides the data and assistance as necessary for the second firm to become a successful producer. The original contractor may receive royalties or technical assistance fees necessary for the second firm to become a successful producer. Direct licensing thus encourages the attitude of competition while deferring most of the active expenses of development of a second source until such competition becomes desirable.

5. Active Techniques to Increase Competition. Active techniques for maintaining or creating two sources include leader-follower, contractor teaming, and reverse engineering. The first two require more up front resources, since we are buying another source now, rather than insurance for an alternate source in the future. Reverse engineering does not require early resources, and is often not listed as a technique for increasing competition, yet seems to have more in common with the active techniques than with the inactive.

a. Leader-Follower. Leader-follower was cited by many studies including Beltramo (1983), Williams (1983), Kidder (1985), and Augusta, Fitzgerald, and Goodman (1986). Here a need exists for another qualified source, generally to meet delivery schedule requirements or to reduce technical or manufacturing risks. This is somewhat similar in concept to the Technical Data Package technique

except that additional support from the leader contractor is anticipated to be required before a successful product can be produced. Since this technique requires considerable liaison between the future competitors, there are several limitations on its use. Contracts with the leader company and the follower company are required. Augusta, Fitzgerald, and Goodman (1986) claim its primary advantage is that if the contract starts during the design phase, two sources will be immediately available at the start of production. As an active technique, the costs are up front. Head to head competition can lead to one contract (winner take all) or a split-buy. A caution is that a winner take all competition for a complex item/technology may again result in a single producer market. Due to this concern a great deal has been written about split buy techniques and problems. See Beltramo (1983), Boger and Liao (1985/87), Meeker (1984), Pelzer (1979), Sellers (1984), and a General Accounting Office report (1984b). The general conclusion to these reports is that both sources must be active competitors if the technique is to have the desired result. Since both sources need to have a sizeable capacity, some will be in excess. Beltramo (1983/86) for one does not view split buys favorably. Rather, he favors winner take all competitions whenever possible, i.e. for items where lead time is short and the product technology is common.

b. Contractor Teaming. Contractor teaming has also been cited in numerous studies. This requires that two (or more) contractors merge their capabilities to design, develop, and validate a DOD product or system, while each develops the ability to be a sole source producer. Following validation the capability exists for direct competition between the former team members. When competition is between two teams at the beginning, there can be competition between teams at the conclusion of full scale development, and still have two qualified sources available to compete for production. This competition can be for the entire production contract, or for a division or portion of the total production. Again this active technique does require up front resources since the government will most likely incur extra proposal and overhead costs. Augusta (et. al.) claims it is well suited to programs where superior design is desired, cost reduction is only a secondary reason, and the system being considered is complex and/or is pushing the state of the art.

(c) Reverse Engineering. When the government finds itself dealing with a monopolist for a specific item, yet without production data or rights to use such data for reprocurement, the government can use the technique called reverse engineering. This is similar to form-fit-function except that F^3 is applied at the start of the life cycle,

while reverse engineering falls much later. Basically the new contractor uses the old product as a model and develops the design and production plans/specifications to support the need. BG Hallin (1987), the Air Force Competition Advocate General, cited several instances where reverse engineering by a second source was used to great advantage.

6. Conditions favoring an attempt to change the market.

Quite a few studies have been performed on appropriate timing for competition in Department of Defense procurements. These include Beltramo (1983), Kidder (1985), and McCann (1986). The results are quite mixed. Sometimes competition has achieved its intended purpose and sometimes it has not. This section of the report will discuss many conditions that have been suggested by these and other reports to enhance the likely value of competition. The conditions have been grouped into factors pertaining to the product, the contractor, and the Government. There is a great deal of overlap as some of the conditions could logically be placed in more than one category.

a. The product.

(1) Data/specifications. The first major consideration about the product is the data. The data must be good enough to allow more than one contractor to intelligently compete. The data should be accurate and of a stable design. The specifications must not be overly restrictive. They could be either performance specifications, or design specifications that are not too complex. The specifications should not favor special processes, tooling, or features that give one contractor a strong advantage. If the item is such that the specifications must be extremely complex or favor one contractor, the item may not be suitable for competition. In order to acquire data that is needed for a well structured competition, several activities must take place. First, the required data must be identified. Second, the rights to the data must be obtained. Next, the data must be arranged in the proper format. Finally, the data must be a separately priced line item.

(2) Quantity of the product desired. A second factor that is important in deciding whether competition makes sense is the size of the program. There are several things to consider about the size of a program. First, "Are there significant commercial applications for this item?" If there are, it might make sense to develop a

second source right away so the original contractor does not enjoy such a large commercial base that he considers DOD business to be unnecessary. If that happens, the DOD is at the mercy of that contractor, at least for the short term.

Another question related to program size is "What value is there to the contractor in winning a follow on contract?" If there is a potentially lucrative follow on contract available, contractors may take competition very seriously. If there is no follow on work expected, contractors may try to milk this contract for all the profits possible.

Yet another aspect of program size is the degree of private research and development required to compete. If a great deal is required, the contractors will probably want to be reimbursed for their costs.

(3) Amount of Risk. The third consideration about the product itself is the amount of risk. Technical risk levels can be lowered by having two competitors trying to solve the same problem. A high tech competition like this sometimes takes more time. If the specifications can be written to include as many mature, "off the shelf" components as possible, the schedule may be shorter and the level of technical risk may decrease. Added advantages of using mature components include improving the producibility

of the item and simplifying maintenance and logistics tasks through the use of interchangeable parts.

Conclusion: There clearly is a relationship between the product, design and quantity, and the probable usefulness of forced or constrained competition. A producer of a very complex product, perhaps pushing the state of the art, has little to fear from competition if the procuring agency did not use one of the passive techniques at the start of the program. For such a complex, high-technology product, perhaps the only passive technique to offer a good chance of success is that of direct licensing. The technical data package approach might prove useful, but technical assistance from the original source may prove necessary, and expensive. If the program is large enough, then perhaps an active technique such as leader-follower, or even contractor teaming might prove useful from the start of the program. The caveats on leader-follower include the caution that the program should be large, there should be time for the effort, and the design should be stable (Thompson and Rubenstein 1979). If the design is not expected to remain stable, then perhaps the government should simply trust its negotiation skills in the bilateral monopoly market.

b. The contractor.

The two main areas of concern with potential contractors are that the contractors be willing and able to perform the work. First, let us look at the willingness of the contractors. Competition is only assured if two or more contractors each strive to win. If one of the contractors is content with its existing market, he will probably not give real competition for a large system. The economic climate for the contractors also makes a difference. If business volume is low, more contractors may want government business. If business volume is high, some contractors may not seriously compete for government business.

Capability of contractors can be investigated both in terms of the contractors' ability to produce the type of product or service and being able to do so in sufficient volume. Many of the systems needed by the DOD are very sophisticated. Contractors must have the technology to produce the item in order to be a credible competitor. Further, contractors must have no problem with obtaining scarce or critical materials. Contractors must have no difficulties with cost accounting standards. Finally, for contractors to really be able to compete, they must not have cash flow problems. Each contractor must have capable, dependable subcontractors and suppliers. If two competing contractors use the same suppliers, however,

there is less chance of lowering costs of purchased parts than if both prime contractors used different suppliers.

The fact that a contractor can produce an item does not necessarily mean that he can produce enough or enough at an economical rate. On large programs it may be worthwhile to consider breaking out components, using a competitive reprocurement, or splitting the requirement between more than one contractor. How large does an acquisition need to be to consider competition? That depends on two things. The first factor is the savings realizable from competition. That will be discussed in the section on costs and benefits. The second factor is how the size of the program relates to the capacity of the contractors.

Contractors have a U-shaped cost structure with respect to changes in volume as described by Kidder (1985). That means there is an efficient production volume. If the volume is considerably lower, the fixed costs must be spread out among the fewer units. This will result in higher per unit costs. If the volume is considerably higher than optimal, the per unit costs also increase. The reason is it becomes very inefficient to produce the last few items. As capacity is saturated, people and machines are stressed, coordination becomes more difficult, less redundancy is built into the system, and many other problems keep the system from running efficiently. If one contractor can produce all the items,

but only at an inefficient (high) rate, it may be useful to introduce competition. If one contractor can produce the item at a nearly optimal rate, but two contractors can only produce the item at much less than optimal rates, it may be better to trust our negotiation skills and stay sole source. Finally, if the required number of items is beyond the capacity of one contractor, two or more must be used.

Another set of capabilities of contractors that should be considered in the decision to compete relates to the learning curve. If a sole source producer is inefficient, that is, on a flat learning curve, another contractor might become competitive quickly and force the learning to a steeper curve. This would be especially true if there were low start up costs, a short lead time for delivery of needed tooling, and few special production skills needed.

c. The Government.

The final group of factors that can indicate greater chance for successful competition concerns the government. First, there are a number of situations that can be imposed on the buying office that can help competition. Second, there are several capabilities that buying offices may have.

Program stability is probably the most important situation that can be imposed on a buying office to help make a successful competition. Stability helps planning,

smooths out fluctuations, allows contracts to be let, etc. Frequent program changes are disruptive and to be avoided if possible. Along with program stability sometimes comes multiyear procurement. Realistic budgeting helps ensure program stability.

Complexity is a way of life in the acquisition process. Keeping this complexity to a minimum helps competition. Users often dictate to the buying office. If users have confidence in the competitive process and are willing to try new sources, competition is easier. Competition does not have to be based on price alone. It can also be based on quality and performance. This allows more freedom in structuring a competition. Unsolicited proposals can be used to further competition if the management chooses to use them.

Timing is another issue faced by buying offices. Sometimes it is beyond their control, other times they can exert an influence. Regardless of who controls the timing, competition should be introduced early in the acquisition to allow flexibility. On the other hand, competition should be introduced late in the acquisition so a good data base can be developed and configuration control is not a problem. These suggestions compete with each other and are program specific.

There are a number of capabilities that buying offices should possess if they wish to introduce competition. First there should be adequate resources, in terms of

adequate government personnel, time, and funds. The funds are to develop new sources and to purchase data. Note that even if the goal of competition is to lower costs, more funding is required up front. If this funding is not available, competition will probably be impractical.

The buying office should have the ability to estimate the costs and benefits of competition. If they cannot do this, they have no idea whether it is cost effective to introduce competition. The buying office should have the ability to identify the true manufacturers of components for possible breakout. Included in this list of components would be items on which the prime contractor adds little or no value. Last, but not least, the buying office must be able to identify contractors to compete. This often must go beyond the normal bidders lists. Good descriptions in Commerce Business Daily and good knowledge of the industry may help identify additional possible competitors.

7. Costs and savings from competition.

While goals of competition can be expressed as pertaining to cost, schedule, and performance; the primary assessments of competition success have been to measure the costs and savings of competition. The purpose of this section is to help make decision makers aware of the various costs and savings, not to evaluate the various models. Several of these models are listed in the

bibliography for the interested reader to investigate. Schedule and performance results have not been evaluated with as much detail.

When measuring success in achievement of cost goals, it is assumed that competition requires certain costs up front and results in certain savings over the life of acquisition. Both the costs and the savings must be measured. A certain amount of cost theory helps one to understand the types of costs and savings to be investigated. Following that, the costs are classified as either non-recurring or recurring costs. The benefits will be listed last.

a. Economies of Scale.

"Economies of scale" is a theory that asserts it often costs one contractor less to produce an item than it would cost two contractors. This is because the sole contractor can negotiate better quantity discounts from suppliers, more fully utilize his productive capacity, use more specialization and thereby increase learning, and amortize costs over a broader base. If two contractors are to compete in a winner take all competition for an uncommon product using unique technology, each must have the required capacity to complete the contract. Someone must pay for this duplication of capacity. A split buy is

another method of competition. This would only be appropriate if there are big start up costs and long lead times to develop production capacity. In this case, the big start up costs are duplicated to ensure the threat of competition later. If there are low start up costs and short lead time, it is easier to threaten an uncooperative contractor with competition. If the buy is split, it is not in the best interest of either contractor to invest as heavily in plant and equipment as it would be for a sole source contractor. This means each contractor in a split buy would probably be producing in a less efficient manner.

b. Non-recurring Costs. Non-recurring costs are out of pocket expenses and some can best be measured as opportunity costs. They are all costs that are only needed if there is competition. Costs to the contractor are grouped into hardware and people costs. Government costs are almost all people costs.

A second contractor must incur certain start up capacity type costs. Since something has normally been learned about how to produce the item, it is often assumed that these costs for a second contractor will only be 75 to 80% as high as they were for the initial contractor according to Kidder (1985). Plant acquisition, rearrangement, or at least opportunity costs must be included. The contractor must have the available plant to

produce the item. Specific tooling and test equipment must also be acquired.

There are a number of personnel costs. First, there is the cost of hiring personnel. If the item has been purchased in large quantities from one contractor, that contractor may have expenses relating to termination of employees after losing part or all of the competition. Once employees are on board, there is the cost of training and educating. There will also be costs associated with initial manufacturing engineering.

Many costs to the government are not ordinarily considered since they are not out of pocket costs. All of the time government personnel spend on the competition, however, is time they do not have to spend on something else. These are real costs. Some competitions may require all of these costs, some may only require a few. The following potential government costs resulting from competition are mostly from Lovett and Norton (1978):

- preparation of solicitation,
- technical data package evaluation,
- preparation of added copies of the technical data package,
- evaluation of offers,
- negotiation of costs,
- preparation of additional contract,

- added audit and preaward survey costs,
- dual should cost studies,
- reprogramming computer from sole source to competition, and
- extra first article testing.

c. Recurring Costs. The whole idea behind the introduction of competition for cost savings is that the recurring costs to the government will be lowered and this will more than offset the increased initial costs. There are, however, a number of recurring costs that actually increase due to competition. These must be considered when calculating expected savings.

Added recurring costs can be identified as those associated with the learning or experience curve, other contractor costs, government costs, and costs that increase for both the contractor and the government. These costs must all be measured in constant year dollars since they may be incurred over a period of years in the future.

One set of costs associated with the learning curve are initial production penalties. The second contractor does not share the lessons of production learned by the initial contractor. Thus, the new source initial costs may be higher than the current costs of the first manufacturer. These initial costs will probably not be as

high as the initial cost of the first contractor, nor will they be likely to diminish as fast since second contractors tend to invest much more in hard tooling. A second set of costs associated with learning is due to breaks in production and production at less than efficient rates.

When two contractors are each capable of producing an item (whether they both actually produce it or not), each must spend money for the following reasons:

- continuing manufacturing engineering,
- quality control,
- contractor program management, and
- deficiency identification and correction.

These costs are sometimes duplicative. In addition to these costs to the contractor, the government experiences certain duplicate costs. Among these are:

- contractor G&A expenses, profit, and cost of money,
- TDY to two contractors,
- Government incremental program management costs,
- spillover costs to other programs, and
- maintenance and logistics costs.

Costs of software reports, testing, and engineering change proposals can increase for both the contractor and the government.

B. Choice of a technique.

Government managers must always assess the product, the program, and the resources of both the government and contractors when considering an effort to increase competition. Each product is bought in a market with a given level of competition. In some cases the nature of the product or program is such that the instant market should be accepted. In other cases the government or contractor resources may preclude attempts to increase the competitiveness of the market. In yet other cases conditions may allow the use of passive or active approaches to improve the number of competitors and/or the spirit of competition.

Beltramo (1983, Table 5.1) presents a set of issues to be considered before the decision to increase competition. His six major areas of consideration deal with the initial source, the item to be produced, the nonrecurring cost to establish a second source, quantity and recurring production costs, risk, and mobilization. Within each area he makes points through the use of questions. For example, "Is there a reason to expect that the initial source will

leads the reader through several checklists that deal with the program in general as well as items that might indicate that introduced competition might bring cost savings. Their checklists deal with:

- Goals of Introducing Competition
- Current Program Size, Length, and Cost
- Possibility of Technology Transfer
- Feasibility Considerations

Given the information provided by working through the checklists, a module of the model estimates the reduction in cost that a second source would have to achieve if the introduction of competition was to result in cost savings. If this is a clearly unreasonable percentage, then the introduction would not be expected to save costs. They thoughtfully include a table summarizing the advantages and disadvantages of each of the dual/second sourcing techniques.

9. Conclusion

The passive and active means given for enhancing the level of competition in the market should be viewed as examples, not as a complete list. The creative aspects of managing and contracting will doubtlessly result in additional ways to enhance competition in the future.

The Air Force and the Department of Defense are charged with the responsibility to plan and manage the nation's defense. Due to the many and varied threats that might need to be countered, resources fall short of 100% coverage. Some identified needs will not be met; some threats will not be countered to the optimal level. In this context of oversubscribed resources, we must strive to be creative and efficient in the managing and contracting process. Where competition can enhance efficiency without damaging the effectiveness of our defense, it should be intelligently employed.

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION: Unclassified	1b. RESTRICTIVE MARKINGS: -
2a. SECURITY CLASSIFICATION AUTHORITY: -	3. DISTRIBUTION/AVAILABILITY OF REPORT: Unlimited, Approved For Public Release
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE: -	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): BRMC 87-2	5. MONITORING ORGANIZATION REPORT NUMBER(S): -
6a. NAME OF PERFORMING ORGANIZATION: AFBRMC / 6b. OFFICE SYMBOL (If applicable): RDCB	7a. NAME OF MONITORING ORGANIZATION: -
6c. ADDRESS (City, State and ZIP Code): Wright-Patterson AFB OH 45433-6583	7b. ADDRESS (City, State and ZIP Code): -
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: - / 8b. OFFICE SYMBOL (If applicable): -	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: -
8c. ADDRESS (City, State and ZIP Code): -	10. SOURCE OF FUNDING NOS.

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
71113F	Ø	Ø4	Ø

11. TITLE (Include Security Classification): Competition In A Noncompetitive Environment (U)	
12. PERSONAL AUTHOR(S): Kankey, Roland D.; Kloppenborg, Timothy J.	
13a. TYPE OF REPORT: Final	13b. TIME COVERED: FROM May 86 TO May 87
14. DATE OF REPORT (Yr., Mo., Day): 1987, May	15. PAGE COUNT: 46
16. SUPPLEMENTARY NOTATION:	

17. COSATI CODES		
FIELD	GROUP	SUB. GR.
5	3	
5	1	9

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number): Competitive Strategies, Acquisition, Contracting,

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This paper deals with attempts by the DOD to instill competition in the DOD acquisition environment. The paper summarizes and synthesizes many of the varied theories, conclusions, findings, and opinions that are present in the literature. The competitiveness of the market can be improved through improved communication, an increased number of customers, and/or an increased number of sources. Several approaches for enhancing the competitiveness of the market are presented and discussed.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT: UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION: Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
Major Richard C. Collins	(513) 255-6221	AFBRMC/RDCB

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

END

7-87

DTIC