

COMPETITION IN DEFENSE ACQUISITIONS

by

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Executive Summary

Competition is a driving force in the U.S. economy and a vital component of efficiency and improved market performance in both the public and private sectors. It has been widely held among economists that competition provides incentives to produce better products faster, at lower costs, and with better quality, while focusing more attention on customer needs. Congress has recognized the benefits of competition and has mandated its use with the *Competition in Contracting Act of 1984*. From a defense perspective, the mandate is simply stated—competition is very beneficial; maximize its use.

In light of the current financial climate in Washington, it is likely there will be an increased pressure to find innovative strategies to maximize the effectiveness and efficiency of DoD's investments in order to meet all operational requirements, as well as modernization needs. Competition within the defense market is not only necessary to efficiently meet day-to-day military needs, but is also the lynchpin for successful military modernization—as a means for spurring innovation of transformational technologies and for bringing the best weapons to the battlefield quickly and affordably.

Competition is important for DoD because it can aid in increasing economic efficiency, innovation, quality, and performance. Competition can aid in economic efficiency (for both systems and services) by forcing firms to keep prices as low as possible in hopes of winning a contract. Likewise, increased innovation results from competitive pressures, as firms seek new solutions to DoD problems through research and development while trying to differentiate themselves from competitors. Competition also impacts quality as firms attempt to improve the quality of a product over time, which has the potential to drive lower-quality firms out of the market altogether. Finally, competition can also directly impact performance improvements for both weapons systems and services.

There are many differences between the defense market and the commercial market, and understanding these differences is a necessity prior to developing acquisition policies and

strategies. Differences in products, market structure, prices, outputs, risk and profits all ultimately have major effects on the type and level of competition that is available. The role played by DoD in not only buying goods from firms but also in regulating the defense market is one of the many features that makes the DoD acquisition environment distinctive from other commercial markets. Other distinguishing factors include the single buyer, the prospect of government-owned facilities, barriers to market entry, import/export controls, barriers to exit, multiple objectives, the politics of national defense, and the unpredictability of national security requirements. If properly accounted for, DoD can leverage its ability to make the rules and enforce them to ensure that competitive practices are being maximized in light of these considerations.

At present, numerous types of competition exist within DoD. Competition for systems can occur prior to an acquisition phase, such as in a competition for development. Competition during development has reaped tremendous success, as exemplified by the Joint Direct Attack Munition (JDAM) program, in which two prime contractors (Martin Marietta and McDonnell Douglas) competed during development and, consequently, reduced development time by 33 percent, development cost by 42 percent, and per unit production price by over 50 percent (Meyers 2002).

In this study, we examine each type of competition undertaken by DoD, including those used for awarding development, production, and support contracts for weapons systems. Competition during production is infrequently used, based on the mistaken belief that it will increase costs. In practice, however, competition during production results in higher performance at lower costs and steeper learning curves achieved by both suppliers. Numerous historical studies have demonstrated the benefits of including competition during production in terms of net cost savings—ranging from 12 percent to 52 percent. Additionally, learning curve theory suggests that when single-source production contracts are re-competed, the original manufacturer would win the largest share of re-competitions (they would be further down the learning curve). In cases in which there has been continuous competition during production, e.g., in U.S. tactical missile programs, the results have shown that the second source actually achieves a steeper learning curve—

ranging from 2 percent to 9 percent more learning (Defense Science Board 1996a). Furthermore, as firms progress down the learning curve in a competitive environment, the addition of a second source forces a steepening of the first producer's learning curve—ultimately contributing to greater cost improvements (Defense Science Board 1996a). Moreover, since sole-source production contracts are often based on historical costs, they create a perverse incentive for the contractor to increase rather than to reduce costs—resulting in learning curves that are generally flatter than projected, or even increasing (as changes are bid non-competitively).

One can also consider how competition affects the cost growth of programs. The cost-growth factors on ten DoD aircraft programs with no production competition—based on actual cost incurred vs. program baseline—increased by 46 percent on average, and only two of the programs presented a modest decrease. These numbers can be contrasted with cost-growth factors for commercial aircraft produced in a competitive environment. These programs show a decrease of between 2 percent and 27 percent, as indicated (a simple average for these programs shows 16 percent decrease over the program life).

A principle theoretical argument usually given against competitive dual-sourcing is that the two firms cannot achieve “economically efficient production rates.” Lockheed-Martin, however, was able to reduce the D5 missile production rate from 60/year to 12/year, while reducing the cost at the same time. Another example is the Navy's DDG 51 Destroyer. In this case, only a very small number of ships were to be built each year, with some years having 1-2 ships built and other years having 4 or 5 ships built. Despite these low production numbers, the contractors were able to keep the costs “fairly stable over time” in constant dollars (Schank 2006).

In addition to the aggregated data, specific examples such as the case of the “Great Engine War” show that the introduction of a second production source yields significant advantages. In this instance, the production competition improved the product's reliability as the shop-visit rate (per 1000 engine flight hours) was half the pre-competition rate, and the scheduled depot return rate went from every 900 cycles to every 4000 cycles. Competition was also directly responsible for lowering warranty costs, as an

initial bid of \$53 million for warranty coverage on roughly \$130 million worth of engine was compared with the second source's bid of a mere 5% premium (Kennedy 1985). In sum, competition in the "Great Engine War" resulted in the competing firms being more responsive to DoD, expanding the industrial base, and leading to a net savings of some \$2-3 billion.

Another specific example of the success that can be had during production for competition can be found within the production of the Tomahawk missile. It was estimated that Tomahawk competition up through FY 1994 would save some \$630 million in then-year dollars (Naval Center of Cost Analysis 1989). As a result of the competition, the Tomahawk's reliability also improved from approximately 80 percent to 97 percent. Several different studies concluded that dual-sourcing saved the government money after only three years of competition and significantly improved the overall performance of the system (Birkler 1990).

Finally, numerous assessments of the recent competition for the F-35 Joint Strike Fighter concluded that dual-sourcing the avionics and engines could have yielded significant cost savings. Ultimately, it was decided that only the "potential" for competition for the production of the avionics would be maintained; although the program savings were significant (estimated at up to 30 percent savings), the initial investment was deemed to be unaffordable in the near-term budgets (Birkler 2001a).

Competitive practices are also potentially valuable with the provision of services. Competition during sustainment operations has been very successful as competitively awarded performance-based logistics (PBL) is growing across the Department—improving weapon system availability and reliability while reducing costs. Competitively awarded PBL contracts have established dramatic improvements in material availability (above 95 percent), world class response times (2-4 days), significant reductions in inventory, and savings of 17 percent over the historic support methods.

Similar to competitions for systems, competition for services can exist in the initial acquisition *for* the services or *during* the provision of the service itself. Much like

competition for production, competition for services too often focuses on the lowest cost, with little accountability for quality of the service once work begins. Alternatively, competition during the provision of services can occur much like competition during production. Umbrella contracting vehicles—such as LOGCAP IV, which qualify several capable contractors but then compete individual task orders—provide a competitive structure that encourages price and performance improvements throughout the contract period.

Competition can also take place for the provision of government-provided commercial activities. These are activities deemed to be not-inherently-governmental and, consequently, that could be carried out by the private sector in lieu of government personnel. Currently, one of the frequently used and effective methods of competition for services government-wide is competitive sourcing via A-76 competitions. These competitions allow government employees to compete with the private sector, and have demonstrated that performance improvements and cost reductions averaging 30 percent are routinely possible—even though government employees win most of these competitions. These savings are not just artifacts of the competition, but have been realized over time. One analysis indicates that for a sample of 16 A-76 competitions, estimated savings did not diminish over time; when all wage, scope, and workload changes are included, the observed savings rate was 24 percent (Clark 2001b). From FY 2003 through 2007, DoD managed to compete a total of 20,520 full-time equivalent positions, with a projected net savings of \$1.8 billion during the performance period—a monumental achievement (Office of Management and Budget 2008).

Competitive sourcing has been very successful, as the introduction of competition (vs. prior monopoly by government employees) has created cost savings while improving on existing performance. Other strategies exist to introduce competitive market forces into services provided by the government and have been successfully used; these include competitive outsourcing, privatization, and public-private partnerships.

The benefits of competition are well established, and although competitive practices are frequently implemented within the DoD, the practice is not being maximized. The

breadth of this implementation varies by Service and often by the type of requirement being satisfied. We believe competition must be maximized during all phases of acquisition, and we make the following recommendations:

- Utilize competition during all phases of a defense acquisition, with specific focus on various forms (and options) of added competition during production of weapons systems;
- Expand the defense industrial base by:
 - Maintaining effective competition at both the prime-tier and sub-tier levels;
 - Giving incentives for firms to enter the defense business;
 - Enlarging the Small Business Innovation Research Program (SBIR);
 - Reducing vertical and horizontal integration;
- Reduce the government monopoly for services where possible through more competitive sourcing, and/or competitive outsourcing, privatization, and public-private partnerships;
- Relax the restrictions on global business practices while retaining the necessary oversight mechanisms for the most sensitive technologies.

We make our recommendations fully understanding that barriers such as the national security environment, the consolidation of the Defense Industrial Base following the end of the Cold War, and restrictions on globalized practices are potential roadblocks to enhancing competition and must be addressed. Specific competitive practices should be used for the enhancement of innovation, efficiency, cost effectiveness, quality and performance for both systems and services. As DoD seeks to transform for the challenges of the twenty-first century, it must rely upon competition to be the cornerstone of its acquisition strategy.

I. Introduction

Competition is a driving force in the U.S. economy and a vital component of efficiency and improved market performance in both the public and private sectors. It has been widely held among economists that competition provides incentives to produce better products faster, at lower costs, and with better quality, while focusing more attention on customer needs. Over the years, many American industries have risen to their most productive and profitable levels when they were subject to the greatest amount of competitive force. This is also true for those in the government market, particularly for defense. While there are significant differences between the defense industry and traditional commercial markets, competition ultimately has the same beneficial effects in defense acquisitions (i.e., in terms of the incentives it creates).

Congress has recognized the benefits of competition and mandated its use with the *Competition in Contracting Act of 1984*. From a defense perspective, the mandate is simply stated—competition is very beneficial; maximize its use. However, currently DoD does not always maximize its options for implementing competitive practices. Factors such as a modified defense acquisition policy (following the end of the Cold War), and vertical and horizontal integration by defense firms have both contributed to the reduced level of competition within the industry.

In light of the current financial climate in Washington, it is likely there will be an increased pressure to find innovative strategies to maximize the effectiveness and efficiency of DoD's investments—in order to affordably meet all operational requirements, as well as modernization needs. Although the exact requirements for future military conflicts are hard to predict, we believe it is essential that the U.S. maintain technological superiority. This superiority will create an unavoidable tension between acquisition of advanced capabilities and the maintenance of current capabilities. Savings from competition will be key to resolving that tension.

As the military works to transform (for the twenty-first century), the ability of the U.S. to have a national security infrastructure that can respond quickly and effectively to

changing operational challenges, while providing maximum flexibility to decision-makers, will be vital. Competition within the market for defense weapons systems and services is not only necessary to efficiently meet day-to-day military needs, but is also the lynchpin for successful military modernization—i.e., as a means for spurring innovation of transformational technologies and bringing the best weapons to the battlefield quickly and affordably.

Organization of the Paper

In Section Two, this paper will first provide background information on competition; we will explore exactly why competition is important for the DoD and explain the economic factors, innovation factors, quality factors and performance improvements that could be expected from acquisitions in a competitive environment. In Section Two, we also explain why competition within the defense market is different from commercial markets. Section Three will examine the specific types of competition for weapons systems that exist within the DoD today—including competition for development, competition during development, competition for production and competition during production. Section Four will examine competition in the provision of services and will explore weapon system sustainment, competition for services, competition during the provision of services and competition for government commercial services—with a special emphasis on public/private competitive sourcing. Section Five will provide recommendations and a brief conclusion.

II. Background

Why Is Competition Important for the DoD and DIB?

Since the end of World War II, the U.S. national security strategy has been to develop and procure technically superior weapons, generally in declining numbers (as opposed to larger numbers of lesser-capable military systems). With the emphasis on researching and developing cutting-edge technology, along with a host of other considerations, defense acquisition has evolved with a set of rules and barriers that differ significantly from the classic, free-market model. However, we believe that by aggressively using competition, the DoD can realize improved efficiency, innovation, quality, and performance.

Economic Efficiency

Competitive markets lead to an economically efficient outcome. In the broadest sense, these outcomes occur when the cost of producing a given output is as low as possible (Pindyck and Rubinfeld 1998). As firms compete with one another, they have an incentive to provide goods and services more efficiently and more effectively. This efficiency aids in lowering costs (thus allowing a firm's prices to be more competitive), as well as in increasing profits, while still providing the highest quality.

Innovation Factors

As the competitive landscape creates pressure on firms to win business, innovation can be a key determining factor in whether one firm is able to differentiate itself from another. Competition creates an incentive to innovate because a firm can determine the potential profit it could earn if it invests in the R&D required to innovate and can compare it to what it would earn if it did not invest (Gilbert 2006). Innovation can refer to the creation of a new invention, as well as the modification of an existing invention that improves that invention somehow. The ability and incentive for firms to innovate within a competitive environment is dependent upon the characteristics of the invention, the strength of intellectual property protection, the extent of competition before and after innovation,

barriers to entry in production and R&D, and the dynamics of R&D. Innovation can also be described as the method by which an invention is brought to market, as well as to the process used to produce it.

Quality Factors

An additional function of competition is the improvement in product quality. This factor is key within the defense industry because, unlike many commercial industries, the defense industry is usually focused on high quality. In this case, a trade-off between efficiency and quality may be made. Thus, as firms compete with one another for the same program, product quality becomes a forcing factor that firms must grapple with to ensure not only that they win the award, but also that once the project begins they are able to deliver a fully operational product (this is especially true with firm-fixed-price contracts). If such competitive pressures do not exist, the firm with the sole-source contract has little incentive to raise quality without raising costs in tandem (Klein 1981).

One additional consideration that must be noted is the provision of additional quality and its effects on the costs of competing firms. Traditionally, an increase in quality is thought of as requiring additional marginal costs (the added costs of additional quality per unit). In that case, a higher-quality firm would not be able to sustain prices at or below those charged by the lower-quality firms, as those firms are producing the item at lower costs per unit. However, if an improvement in product quality can be made through either product design changes or production process changes, the firms with higher quality built into their product or process from the beginning can potentially match (or even undercut) the lower-quality firms on prices. Consequently, competition in this case can lead to greater quality and would ultimately drive the lower quality firms out of the market, as they are unable to compete—resulting in better quality and lower prices for DoD altogether (Cohen 2004).

Performance Improvements

Just as competition can spur innovation, efficiency and quality improvements, competitive pressure can also improve performance. Performance improvements can be

considered anything that improves or expands an existing product's performance characteristics. As firms compete and/or recompute for the opportunity to build a system for DoD, performance characteristics can be distinctive factors that ultimately allow one firm to beat another. When using a "best-value" source selection, criteria such as system performance can be taken into account during the award process, even if it means an increase in the costs. Thus a cost/benefit analysis can be completed by the department or agency to assess precisely how much performance it is willing to buy. It should also be noted that performance is equally important, or perhaps more important, when it comes to the delivery of services. And, often, if "unit cost" is a primary design consideration, the result can be higher performance at lower costs.

Why Is Defense Industry Competition Different?

The term "perfect competition" is used by economists to describe a hypothetical market form often used to model the behavior of commercial markets. The result of "perfect competition" is that neither producers nor consumers have the market power to influence prices. This model is based on several assumptions. First, there are large numbers of competing buyers and sellers—individual actions have little impact on the market, and the firms have to take the price offered by the market. Second, both the producers and consumers have perfect information. Third, from the consumers' perspective, the goods and services produced are substitutable. Fourth, all of the producers have equal access to production technologies. Finally, all have the ability to enter and exit the market freely.

Unlike in other market forms (for example a monopoly¹ or oligopoly²), a firm in a perfectly competitive market generally does not make excessive profits. If it does in the short run, more firms enter the market and drive down the prices. This theoretical model is, however, a distant approximation of reality, since few of these assumptions hold true in most real-world cases. This is especially applicable when considering the acquisition

¹ A monopoly is defined as a persistent market situation in which there is only one provider of a kind of product or service.

² An oligopoly is the market form in which a market is dominated by a small number of sellers.

of major DoD weapon systems, as well as more generally within the context of the defense industry—particularly since DoD is a monopsonistic³ buyer.

In broad terms, DoD has three major acquisition categories—(1) DoD-unique parts, equipment, and systems, (2) commercial supplies, parts, and equipment, and (3) services. The weapon systems that DoD procures are generally very high tech, purchased in small quantities, and at a high unit cost. The commercial market, on the other hand, procures items with proven technology, generally buys items in large quantities and at relatively lower unit costs. Understanding the differences between the defense weapon system market and the commercial market is a necessary first step in developing acquisition policies and strategies. A contrast of the free market conditions and those found in the defense industry are presented in Figure 1. However, since not all of the conditions of a perfect market can be met, removing some obstacles and moving toward the conditions of a free market alone may not improve efficiency; policy analysis must keep the theory of second best in mind.⁴

³ A monopsony is a single-buyer market.

⁴ The absence of “perfect competition” does not, however, negate all economic theory. At the general level, the economic “theory of the second best” must be used for analyzing the desired market characteristics and policy options. This theory, formalized by Lipsey and Lancaster, states that if one optimality condition in an economic model cannot be satisfied, then an optimum situation can only be achieved by departing from all the other previous optimum conditions. Therefore, a situation achieving more of the optimality conditions is not likely to be superior to a situation in which fewer are achieved (Lipsey 1956).

Aspect	Commercial	Defense
Products	Proven Technology, rapidly applied	Cutting-edge Technology, slowly applied
Market Structure	Many buyers and multiple producers	One buyer, large items bought in small quantities
Demand	Competitive, sensitive to price and quality	Monopsonistic, rarely price-sensitive, driven by maximum performance
Supply	Competitive, adjusts to demand	Oligopolistic, large excess capacity
Entry and Exit	Movement in and out of market	Extensive barriers to entry and exit (e.g., unique DoD “requirements,” perception of higher cost of two suppliers, Congress)
Prices	Constrained by market competition	Cost-based and regulated
Outputs	Constrained by market competition	Determined by government
Risk	Borne by firm	Shared between firm and government
Profits	Constrained by market competition	Regulated by the government
Competition	In production	Generally only for R&D

Figure 1. Evaluation of the Commercial Marketplace vs. Defense Marketplace

Other Defense Market Differences

- Government-owned Facilities.*** The government owns a significant amount of the plant space and equipment used by defense contractors—these facilities are commonly referred to as a government-owned, contractor-operated (GOCO) facility. For example, nearly one-third of the plant space in the aircraft industry is owned by the government. Air Force Plant (AFP) 42, a major GOCO facility located in Palmdale, California, is one such facility. It has over 3 million square feet of government-owned industrial space that is used by contractors in support of the X-37, Airborne Laser, Global Hawk, F-35 and B-2 bomber.
- Barriers to Entry.*** The barriers to entering the defense market are extremely high. In addition to the cost advantage of the incumbents, the capital requirements, the unique technologies, and the number of competitors, firms entering the defense business face added obstacles. These include the required knowledge of federal acquisition

regulations, specialized accounting and reporting requirements, the need for security clearances, and the ever-present consideration of Washington politics. As a result of these barriers, it is quite infrequent that new firms get into defense markets—the barriers to entry are just too high (Gansler 1995). Furthermore, Congress has passed numerous rules and regulations in an effort “to protect the government” from unqualified bidders who may arise in the case of “full and open” competition. Perversely, such an excessive amount of regulation creates a significant barrier and greatly restricts the amount of effective competition (Gansler 1989).

- ***Export/Import Controls.*** These restrictions on defense-related products and services are another differentiating characteristic between the defense industry and other commercial industries. While in some other domestic markets restrictions do exist, the breadth of the restrictions in the defense market and the political nature of providing defense goods and services to a foreign country make it incredibly difficult for a firm to expand its market outside of the United States. Often, firms will seek to expand their business if they are seeking to offset slumping domestic sales or to increase production efficiency by selling more units. Likewise, due to these restrictions for U.S. defense firms, the very same restrictions hamper the DoD’s ability to gain access to the very best goods and services that are available on the global market. Examples of policies that make it difficult for firms to do business with the DoD include the *Buy American Act*, the *Berry Amendment*, International Traffic in Arms Regulations (ITAR), export controls, and the numerous restrictions on science and technology workers. The aforementioned restrictions also serve as barriers to introducing effective competitive practices into Defense Department acquisitions. Failure to maintain competitive pressure by leveraging the resources of a globalized industrial economy could result in DoD being short of critical equipment, behind schedule on new procurements, and well below an acceptable level on the cutting-edge-technology curve.
- ***Barriers to Exit.*** Barriers to exit include specialized capital equipment, high overhead cost, and government sponsorship of defense-unique research. The defense market is also unique because many of the items procured by DoD cannot be sold in

the commercial marketplace. Overall, as compared with many commercial items, military-specific systems are often more complex. This complexity adds to increased development costs and risks associated with undertaking military-specific technologies, as their application outside the DoD may not be possible. As a result, many firms shy away from this type of work and instead shift focus to products or services that could be sold in both the commercial sector and government sector.

- ***Multiple Objectives.*** In addition to meeting the military requirements, DoD leadership must also consider the government's mandated social and economic goals alongside the program's impact on the defense industrial structure. An evaluation of these effects is generally based on qualitative judgments and can be especially hard to convert into dollar amounts; consequently, their impacts on programs can be difficult to assess.
- ***Size/Scale.*** Another consideration that makes business with DoD different is the size and scale of DoD contracts. Based on the large size and scope of many defense contracts, generally only a select few firms are able to provide goods and services that meet the requirements.
- ***National Defense is a Highly Political Issue.*** DoD's role in the monopsony market is also different than traditional commercial markets because of the volatility that can exist regarding the politics of defense, especially in light of the future financial state of the nation. First, the United States will have to address long-term budgetary challenges such as growth in Social Security, Medicare and Medicaid. Because it is inevitable that future DoD budgets will be under tremendous downward pressure in light of these and other federal government obligations, an efficient use of resources will be required—only making competition more important to improve the efficiency and effectiveness of DoD's acquisition process.

Second, internal shifts in DoD budgetary priorities are heavily debated. Many believe that the single largest issue facing DoD in the coming decade will be the discrepancy between Department requirements and funding (Grossman 2008). Because of the pressure for the military to adapt and respond to new military missions and

requirements, funding for equipment, personnel, operations & maintenance (O&M) and homeland security will also be dependent on the requirements of ongoing and possible future military operations, ultimately impacting the effectiveness of long-term planning.

- ***National Security Requirements.*** The ability to respond to the changing demands of national security requirements also serves as a major differentiating factor from the commercial sector. As the United States will undoubtedly face a wide array of unpredictable threats in the twenty-first century, not only must it be prepared for the potential of dealing with a “near peer” or a peer competitor, but also its defense establishment must also be able to address the asymmetric threats posed by terrorist organizations and other non-state actors. The ability for the defense industry to respond to these challenges will ultimately have a direct influence on DoD’s success in military operations, in addition to having a potential impact on American loss of life. This factor can also serve as a barrier to implementing effective competition practices, as claims of compelling urgency or national security requirements can be used to limit competition. However, this issue only highlights the need for expansion of streamlined, competitive acquisition practices to ensure that the most urgent concerns can be addressed through the proper channels, in a full and open, competitive marketplace that incentivizes providers to be faster and less expensive.

A Monopsony Buyer Dealing with Oligopolies

Following the end of the Cold War, significant defense budget cuts were made in the 1990s; the DoD recognized that projected defense spending would not be able to sustain the existing industrial base. In light of this, the DoD passed various measures to encourage defense firms to consolidate. As of today, only six of fifty prime contractors from 1990 remain in business; in addition, the defense industry has gotten significantly smaller relative to the size of the overall economy, as compared with the Cold-War era establishment.

DoD’s strategy was based upon the belief that consolidation increased the efficiency of the remaining firms. Thus, a consolidated defense industry would, thereby, reduce overall

costs through mechanisms such as combined operations and decreased overhead allocations. In some cases, the consolidation (by both vertical integration and DoD-encouraged horizontal mergers) has created monopoly-like market conditions for those with the expertise and infrastructure required to operate within the government procurement system (Davis 1996). As firms merged with one another over time and programs within the industry dried up following the cuts in defense spending, market power shifted from many firms into the hands of only a few. And, as a result, in virtually all defense sectors there are just a small number of potential suppliers—creating oligopolies.

When one considers the defense market, there is generally only one buyer: the government; hence, there is a monopsony market. In a monopsony market, the producing firms are competing for the single buyer's business. A monopsonist generally has market power because it can affect the market price of the purchased good by varying the quantity bought. Within the DoD, this power is somewhat diminished, since in reality the DoD is not a singular, unitary buyer. The acquisition function is spread across the military services, defense agencies, and Congress. Within the Services, there are rivalries, as well as many different program offices. These program offices are often competing for budget share, resources, and distinct priorities—not only among services, but also among elements of each service. In a real sense, these program offices are the real “customers” of defense firms, and the pure monopsony model loses some of its descriptive power (Kovacic 1994).

Michael Porter, a Harvard Business School Professor, developed a useful framework that can be used to evaluate the nature and degree of competition in an industry. Porter identified five competitive forces that he believes shape an industry. These forces are: the threat of entry by new competitors, the bargaining power of buyers, the bargaining power of suppliers, the threat of substitute products, and the jockeying for position among existing competitors. The “five forces” model takes into account supply and demand; substitutes and complementary products; relationships between costs and volumes of production; and market structures (like monopoly, oligopoly, and perfect competition). Porter's framework provides a structured and easy-to-understand way to

examine and analyze an industry. Figure 2 below depicts the five forces Porter identifies as applied to the defense industry, and provides some elaborating detail.

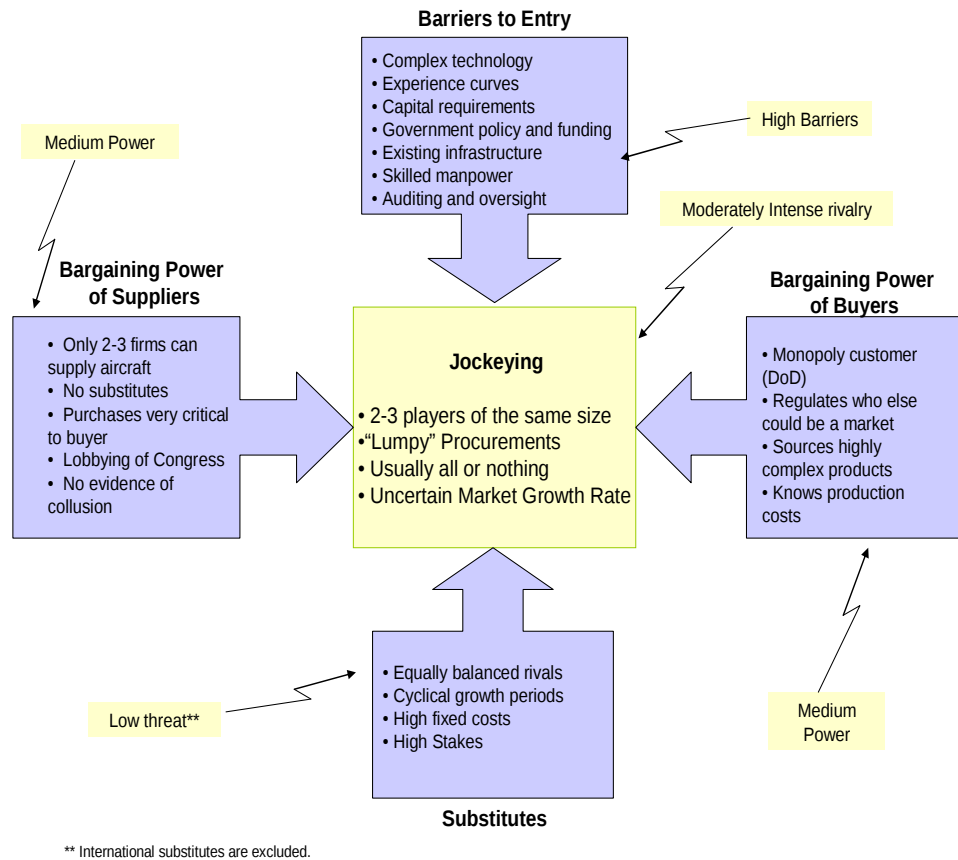


Figure 2. Competitive Forces Adapted for Defense Market (Adapted from Porter (1980))

From this analysis, we can see that within the defense industry, barriers to entry are high and restrict market entry; therefore, some bargaining power shifts to the sellers. Additionally, since the defense industry is required for national security, and there is a low threat of substitutes, the government loses some of its purchasing power. The cumulative result is that the government's monopsony power is reduced (Porter 1980). This makes it critical for there to be two or more viable competitive suppliers for each product or service so the government can balance their power. Such conditions (unless two or more competitors can be maintained) ultimately serve as barriers to competition and negatively impact the adaptability, flexibility, responsiveness and efficiency of the firms in the market.

Of additional consideration within this market is the lack of coordination across commercial industries that horizontally align with the defense sector. For example, biotechnology could potentially play a key role in defense against biological attack both at home and abroad. Yet, little coordination has been made between the biotechnology sector and the defense sector, as DoD funding for biotechnology is minimal. The case for the biotech industry to get into the defense business has not been made, because the policies and funds are not in place to attract its members. Hence, competitive forces have not been harnessed to capitalize on new, innovative biotechnological solutions to defense-related problems.

III. Competition within DoD Today

In the previous section, we outlined the general impacts that competition can have on defense acquisition, and why it is important for efficiency, innovation, quality, and performance. In this section, we will examine data and specific cases in which these important factors have existed within the various competitive frameworks of DoD acquisition. As these cases will show, the department benefits significantly from competition—particularly during the production phase, in which it is often not employed.

Competition for Systems

The DoD strives to maintain a competitive environment in its weapon acquisition program. Competition for a major defense weapon system is, however, very different than experienced in most civilian markets. For example, in the civilian automobile market, when one car manufacturer doubles the price of its vehicles, consumers can switch and buy other similar vehicles. On the other hand, if a defense supplier significantly raises the price of a particular weapon system, DoD usually has little choice except to attempt to negotiate the price down.

Even though the competition is generally fierce for the initial award of the development of a weapon system, once that award is made, the weapon system is generally developed, produced, and supported by a single firm—a relationship that frequently lasts for many years (often decades). The subsequent absence of a buyer's alternative in the defense market creates a sole-source environment; this alone makes a critical difference in the defense market.

Another unique feature of the DoD's weapon acquisition process is that it involves several distinct phases. As a result, there are a large number of sequential decisions and contract negotiations that take place between the DoD and the prime contractor during the course of an acquisition. These decisions and negotiations result from the long program durations, DoD's institutional preference for short-term, sequential decisions (including funding decisions), and the changes to product requirements and specifications

over time. Commercial markets, on the other hand, typically have a more simplified and continuous transaction process.

Because competition is (or often should be) used during the various stages of weapon system acquisitions, it is important to understand these differences.

Competition for Development

Competition for development occurs when firms compete to develop a product. Multiple contractors are usually funded to take advanced technology and match it to a military mission. There is often a vigorous competition for this design stage, which can take three to eight years. Development contracts are generally awarded to the contractor that promises the most capability and offers the least price. This stage ends when DoD selects a preferred design or designs and makes the decision to build a prototype of the weapon (Gansler 1989).

Competition for development is important because of the uncertainty that generally exists during this phase of new weapon system development. Not only does competition at this stage give DoD the ability to gain the benefits of innovation and potential lifecycle cost savings, it also ensures that sufficient alternatives exist which could perhaps be integrated into the program at a later date. In other words, one of the fundamental purposes of the development phase is the creation of new ideas and approaches to DoD mission requirements; thus, a competitive environment only fosters greater development potential. One major drawback, however, of competition for development as often practiced is that once the development contract is awarded, the program transitions to a sole-source environment. When the pressures of the competitive environment no longer exist, there is little incentive for the winner to strive to improve performance, reduce cost, and maintain the program schedules. Consequently, the general trend has been that firms that go out of their way to be over-optimistic during development ultimately struggle during production—resulting in performance compromises, failure to meet schedule guidelines, and, in many cases, cost growth via change orders and other mechanisms.

Competition during Development

Even though competition for development is competed (i.e., a “down selection” is made), there is an opportunity to maintain competition during the development phase. Although dollar values are still small, the commitments are firmer. Based on the expense, the number of competitive contractors for advanced weapon systems is normally limited to two. This stage typically takes from two to seven years (Gansler 1989). Compared with competition for development, competition during development requires teams to compete side-by-side throughout development stages with the hopes of creating a winning design that would be suitable for production. Competition during development is becoming more popular for larger, technical projects, where the DoD may have an idea of the capabilities it is trying to achieve but looking to create a competitive environment that will spur innovative solutions. For example, two contractor teams (Northrop/McDonnell-Douglas and Lockheed/Boeing/General Dynamics) were selected for the initial demonstration/validation phase fly off between the YF-22 and YF-23—the original designations of the eventual winner: the F-22. In many cases, however, the selected design is awarded sole-source to a single contractor. The selected developer, therefore, faces no competition during this phase, although the government always retains that option.

Based on the cost of new weapon systems and current acquisition policy, early competition in the system lifecycle is very desirable. By sponsoring the concurrent development of two or more competing weapon systems (or key subsystems) that represent potential substitutes for filling a presumed military need, the government can hedge against uncertainties. This reduces the risk of being committed to an unsatisfactory approach and increases the probability of obtaining an acceptable end-product (Scherer 1964). Additionally, competition during development results in less expensive, more technologically innovative, and better integrated systems. This generally leads to earlier system maturity dates and significant lifecycle savings.

The Joint Direct Attack Munition (JDAM) is another example of the advantages from competition during development in an acquisition. In this case, two prime contractors

(Martin Marietta and McDonnell Douglas) competed against each other during development and, consequently, reduced development time by 33 percent, development cost by 42 percent, and an average per-unit cost reduction of more than 50 percent (Meyers 2002).

The JDAM competition was also carefully structured, to include:

- Performance-based requirements, without mandatory specifications and standards;
- Low cost as a key parameter up-front;
- Emphasis on price/performance tradeoffs;
- Streamlined oversight (contractor and program office);
- Configuration control maintained by contractor;
- Commercial-like lifetime warranty (20-year shelf life, 5-year service life);
- Source selection award criteria based on past performance and best value (Meyers 2002).

The results that were achieved with the competition during development for the JDAM were remarkable and indicative of the types of results available with a well-planned competition during this phase. The competition was held to more commercial-like standards and allowed the contractors to have the freedom to use whatever design parameters they desired. The DoD focused on performance characteristics and price, and, in this case, it was the competitive pressure initiated by the rules of the contest that created the final outcome: an outstanding product in JDAM.

Competition for Production

After the development is complete, DoD can move to production of the weapon system. If there has only been a single contractor during the development phase, the production contract is generally negotiated in a sole-source environment with the contractor that completed the initial development; otherwise, a second source must be qualified. If two alternate systems were developed, then assuming they both meet the mission requirements, DoD can compete the two contractors for the production effort.

In the end, if production is initiated with only one source, the competitive pressure is removed, and competition for production can essentially be viewed as the award of a sole-source production contract. In most cases, just as with competition for development, the sole-source nature of the award causes extreme optimism on pricing. Production efforts can often last for decades—with little incentive to increase efficiency—since the projected learning curves are not achieved, and change orders emerge as opportunities for generating additional profit.

Competition during Production

There is a natural tension between the relative benefits of a single-source award and the relative advantages of using competition during production, which include the benefits of learning/experience and the economies of scale. The learning curve⁵ effect expresses the relationship between experience and efficiency. The underlying premise is that as individuals and/or organizations become more experienced at a task, they usually become more efficient as well.

Learning curve theory suggests that the total cost of an item will be minimized, with all other things being equal, if one procures that item from a single manufacturer. The fundamental premise of the learning curve is that the producer is attempting to increase returns by reducing the cost of production in a competitive market. However, all other things are rarely equal. Therefore, when learning curves are employed to project the cost of sole-sourced produced systems, the projected learning is rarely achieved without the presence of a competitive market to cause the contractor to continuously strive for greater and greater efficiencies.

Competition during production permits firms to compete during the production process (in stages or phases) for the award of additional production, allowing for the avoidance of monopolist tendencies that occur from a sole-source-award-winning producer.

⁵ Learning curve theory, often used as a measure of efficiency in manufacturing, is a demonstration of how a firm learns a process and is able to thus become more efficient over time. The learning curve theory demonstrates the relationship that links experience doing (learning) a task and increased levels of efficiency in performance of that task.

Ultimately, competition during production results in higher performance at lower costs and steeper learning curves achieved by both suppliers. Numerous historical studies have demonstrated the benefits of including competition during production in terms of cost savings—ranging from 12 percent to 52 percent—and are detailed in Figure 3 below.

Study Organization	Year	Number of Systems	Observed Net Savings
Scherer	1964	--	25%
McNamara	1965	--	25%
Rand	1968	--	25%
BMI	1969	20	32%
Army Electronics Command	1972	17	50%
LMI	1973	--	15-50%
Joint Economic Committee	1973	20	52%
IDA	1974	20	37%
LMI	1974	1	22%
ARINC	1976	13	47%
APRO	1978	11	12%
IDA	1979	31	31%
TASC	1979	45	30%

Figure 3. Savings Achieved from Competition during Production (Defense Science Board 1996b)

These results have been reaffirmed in a more recent study that examined the effects of competition on 14 tactical missile programs over the period of 1975-1995. This study concluded that dual-sourcing production produced net-savings on the order of 20 percent (even after considering the added costs of two sources and the reduced quantities of both suppliers). Dual-sourcing also increased the availability of supplier information between competitive suppliers that resulted in more aggressive bidding; it also gave the government more leverage on non-contracted issues of quality (Lyon 2006).

Learning curve theory would also suggest that when single-source production contracts are re-competed, the original manufacturer would win the largest share of re-competitions (they would be further down the learning curve). In cases in which there has been continuous competition during production in U.S. tactical missile programs, the results

have shown that the second source actually achieves a steeper learning curve (see Figure 4)—ranging from 2 percent to 9 percent more learning (Defense Science Board 1996a).

Program	Cost-improvement Rate		Percent Difference
	First Source	Second Source	
AIM-7F	0.87	0.84	3.00%
BULLPUP	0.82	0.80	2.00%
TOW	0.98	0.89	9.00%
AIM-9L	0.90	0.83	7.00%
AIM-9M	0.94	0.85	9.00%
HELLFIRE	0.94	0.92	2.00%
TOMAHAWK	0.79	0.71	8.00%

Figure 4. Cost-improvement Rate in Dual-source Production and the Learning Curve (Defense Science Board 1996a)

Additionally, as firms progress down the learning curve in a competitive environment, noticeable savings can be well documented. The addition of a second source forces a steepening of the learning curve and can be viewed as “breaking the curve”—ultimately contributing to greater cost improvements, as demonstrated in Figure 5 (Defense Science Board 1996a).

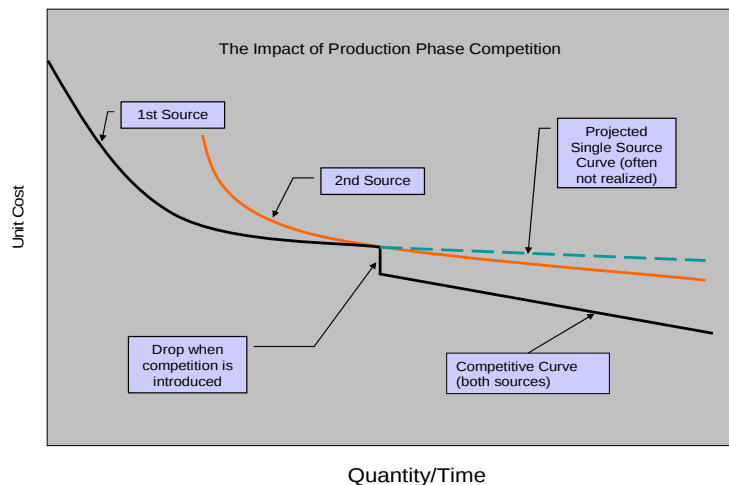


Figure 5. Initial Source Reactions to Competition during Production

Finally, it should be noted that pricing for sole-source production contracts is often based on historical costs and, thus, creates a perverse incentive for the contractor to increase rather than to reduce costs—a problem that is easily avoided with dual-source production. For this reason, in the defense environment, sole-source learning curves are usually flatter than projected; in many cases, the total program costs have shown significant increases.

One can also consider how competition affects the cost growth of programs. The cost-growth factors on the DoD programs with no production competition (based on actual cost incurred vs. program baseline) increased by 46 percent, on average. Of the 10 programs studied, most showed an increase between 25 percent and 104 percent. Only two programs—A-6E/F and B-1B—presented a modest decrease (see Figure 6).

Aircraft	Cost-growth Factors
A-6E/F	0.96
B-1B	0.98
C-17	1.70
EF-111A	1.62
F/A-18 A-D	1.54
F-14A	1.25
F-15A-D	1.47
F-16A-D	1.29
JSTARS	2.04
T-45	1.74
Average	1.459

Figure 6. Cost-growth Factors for DoD Aircraft Programs with no Production Competition (Birkler 2001a)

These can be contrasted with cost-growth factors for commercial aircraft produced in a competitive environment. These programs show a decrease of between 2 percent and 27 percent, as indicated in Figure 7. A simple average for these programs shows 16 percent decrease over the program life (Aircraft Value Analysis Company 2006).

Aircraft	Net Cost Growth*
B737-400	0.76
B757-200ER	0.80
A310-300	0.98
A320	0.92
A330-300	0.86
DC10-30	0.83
MD-11	0.73
Average	0.84

Figure 7. Summary of Commercial Aircraft Produced in a Competitive Environment

Other military programs without a second source of production present demonstrate that without competitive pressure, little incentive exists for a firm to keep a program on schedule or budget, ultimately resulting in the significant cost growth shown Figure 8.

Program	Cost-growth Factors
Longbow Apache - AFM	2.19
Bradley/IFV/MICV	2.29
TOW II	1.15
M-1 (Abrams)	1.59

Figure 8. Cost Growth Factors for Non-Aircraft Programs with No Competition during Production (Birkler 2001a)

One other benefit of dual-source programs was identified in a 2001 Office of the Secretary of Defense Cost Analysis Improvement Group (CAIG) study. This study examined the cost growth of sole-source and dual-source programs based on program changes and technical problems that the CAIG identified as “mistakes.” These mistakes included:

- Production quantity assumptions and estimation changes;
- Engineering, test, and development changes;
- Integrated Logistics Support (ILS) changes, and spares and support changes not attributable to post-milestone II discretionary decisions;
- Schedule slips attributable to technical problems;

- Other changes not attributable to discretionary changes.

As shown in Figure 9, the cost growth during Engineering and Manufacturing Development (EMD) of dual-source programs (AIM-9M, AMRAAM, HARM, Hellfire, Peacekeeper, and Tomahawk) is 7.4 percent—approximately one fourth that of non-dual-source programs (29.4 percent). The cost growth during procurement exhibits a similar pattern: 4.1 percent for dual-source programs vs. 15.2 percent for non dual-source programs.

	Dual-Source	Non Dual-Source
Number of Programs	6	19
Percent EMD Changes Cost Growth	7.4%	29.4%
Percent Procurement Changes Cost Growth	4.1%	15.2%

Figure 9. Cost Growth in Dual-Source Programs vs. Sole-Source (OSD CAIG 2001)

A principle theoretical argument usually given against competitive dual-sourcing⁶ is that the two firms cannot achieve “economically efficient production rates.” We believe that by shifting the total production curve to lower efficient rates, this issue can be mitigated. This was demonstrated by Lockheed-Martin within the Trident D5 Fleet Ballistic Missile⁷ program. The D5 program reduced the missile production rate from 60/year to 12/year; however, by changing its production curve, the unit cost was reduced at the same time (see Figure 10). This point is further illustrated by looking at the competition for the Navy’s DDG 51 Destroyer. In this case, only a very small number of ships were to be built each year, with some years having 1-2 ships built and other years having 4 or 5 ships built. Despite these low production numbers, shipbuilding costs have remained “fairly stable over time” in constant dollars (Schank 2006).

⁶ In two recent cases (the second engine for the F-35, and the Tanker acquisition of a commercial aircraft), the Air Force has chosen a production sole-source (down-select) vs. dual-source (continuous competition)—in part using production efficiency arguments, thus giving up higher performance at net lower cost for sole-source “promises.”

⁷ The *Trident II D-5* is a three-stage, solid propellant, inertia-guided missile with a range of more than 4,000 nautical miles and armed with multiple, independently targeted reentry vehicles.

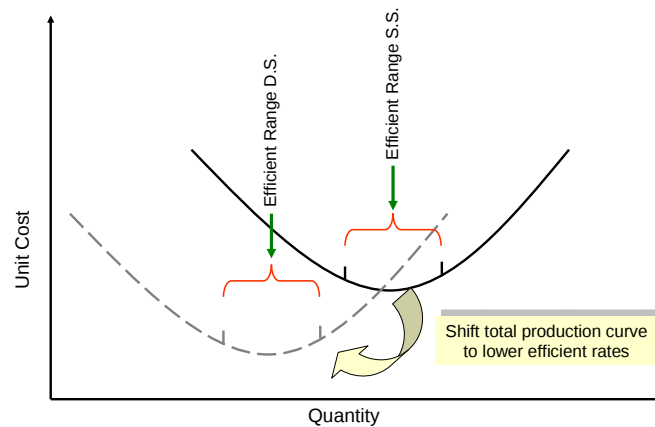


Figure 10. Dual-Source vs. Sole-Source Production Efficiency

In summary, the ever-present threat of competition during the development and production phases of weapon system acquisition is a most effective performance inducement that results in increased innovation, performance improvements, quality improvements, and net cost savings—better value for DoD and the U.S. taxpayers. The following specific cases (the “Great Engine War,” Tomahawk Missile, and Joint Strike Fighter) are used to highlight these benefits.

IV. Examples of Competition during Production

The Great Engine War

The Alternate Fighter Engine (AFE) program is a classic example of a DoD weapon system acquisition program in which competition was successfully applied during production.

The so-called “Great Engine War” got its name as a result of an intense competition during the production of a replacement engine for the F-15 and F-16 fighter aircraft during the early 1980s. The initial engines—designated the F100 and constructed by Pratt and Whitney (P&W) for the F-15 application during the mid-1970s—were developed and produced in a sole-source environment, and, while they displayed outstanding performance qualities, they experienced both durability- and performance-related problems toward the end of the 1970s. The Air Force considered these faults to be a result of the P&W monopoly on engine production. In sum, the Air Force believed P&W had gotten comfortable in its contracting arrangement to supply F-15 engines and was not trying to improve upon its original design during the production period (Kennedy 1985).

At the operational level, there was a need to improve reliability and durability of engines and to reduce overall lifecycle costs of the aircraft. The Air Force was continuing to experience poor durability and high maintenance costs of the F-15 engines. These were caused primarily by the failures of the F100’s fuel delivery system, the turbine problems, and performance problem identified as “stall stagnation.” Stall stagnation occurred when a pilot suddenly called for full throttle at high altitude and low speed; under these conditions, the F100 engine had a propensity to stall while fuel continued to pour into its combustor. This problem could seriously damage the engine. The only way to avoid this damage was for the pilot to shut down and restart the engine in flight; this was unsafe during training and completely impractical for wartime operations. The Air Force and P&W could not agree on who should pay to fix the problems, and the relationship between them deteriorated as the problems with the F100 equipped fleet persisted (Kennedy 1985; Drewes 1987).

On top of this concern, once development for the F-16 began in the mid 1970s, the existing F100 engine was planned to be used with the new aircraft's design. Now both of the Air Force's frontline fighters were dependent on the same engine. Furthermore, there was an increasing concern within the Department of Defense about the sustainability of the industrial base (Camm 1993).

The "winner-take-all" approach of these two procurements had effectively excluded the other U.S. engine contractor, General Electric, from the Air Force fighter engine market. At the time, General Electric (GE) had invested its own resources into developing what it thought could be a great replacement engine for the Navy's F-14, known as the F101X. While the Navy showed little interest in this engine, the Air Force believed that the F101X could provide a much needed competitive spark to P&W and could force innovation and cost savings through improved durability and reduced operating costs. It offered GE a chance (Camm 1993).

The Air Force invited GE to compete against P&W, and both firms submitted their bids in 1983 for the AFE, in response to the Air Forces request for proposal. Following the proposal process and source selection, a dual-production award was made with 75 percent (120 units) of the build going to GE's new Air Force engine variant known as the F110, and 25 percent (40 units) going to P&W's existing F100 engine for FY 1985. The strategy employed called for re-competing the split-buy every year, to force both firms to continue to contend with one another for a greater portion of the production split. Given this strategy, the Air Force would continuously re-evaluate price and performance among several other characteristics to determine a winner (Kennedy 1985). The results of the "Great Engine War" are noted below:

- Improved Reliability: The competition vastly improved the reliability, maintainability, and durability of the fighter aircraft engines while providing better performance. Specifically, the shop-visit rate, per 1000 engine flight hours, was half the pre-competition engines. Additionally, the scheduled depot return increased from every 900 cycles to every 4000 cycles (Camm 1993).

- **Improved Contractor Responsiveness:** The competition forced the contractors to be more responsive, efficient, and effective, which benefited the contractors as well as the government. The competitive pressure forced P&W and GE to treat the Air Force more like their commercial customers, upgrade their manufacturing capability, and make other capital investments to reduce costs and improve quality.
- The competition also significantly enhanced warranty coverage and lowered warranty costs, which further reduce government costs. Before the competition, the single source P&W had offered the service warranty at a cost of \$53 million. The competitive bid by General Electric offered a significantly lower cost—a 5 percent premium. This counter by GE forced P&W to revise its first bid and negotiate a sum significantly below the \$53 million (Kennedy 1985).
- **Expansion of Defense Industrial Base:** Other benefits included that the competition allowed dual lower-tier suppliers, enhanced operational flexibility, enlarged industrial base, and provided considerable protection from production disruption.
- Finally, the program office estimated that the competition yielded between \$2-3 billion in net savings (then-year dollars) in the twenty-year lifecycle costs of ownership, compared with continued sole-source procurement of the existing F100 engine (Kennedy 1985).

Given these results, it is important to identify the key reasons the “Great Engine War” competition was so successful. Specifically, the factors that enabled the above-noted outcomes included:

- *Low technological risk: Both GE and P&W designs were proven; i.e., they relied on existing technology that only required adjustments rather than a major overhaul.*

- *No risk from outside programs: there was no serious risk from outside the programs, such as the unexpected changes in policy or government funding which might have affected the support for the developments.*
- *Low cost of adding second source: Since development of both engines was completed already and infrastructure was in place for production.*
- *Competition was used to motivate the contractors: Especially the warranty that accompanied the production contracts; it forced both contractors to honestly reveal their expectations about actual performance of their engines.*
- *Contracts: Contracts were fixed price and required warranty coverage, further creating competitive pressure (Drewes 1987).*

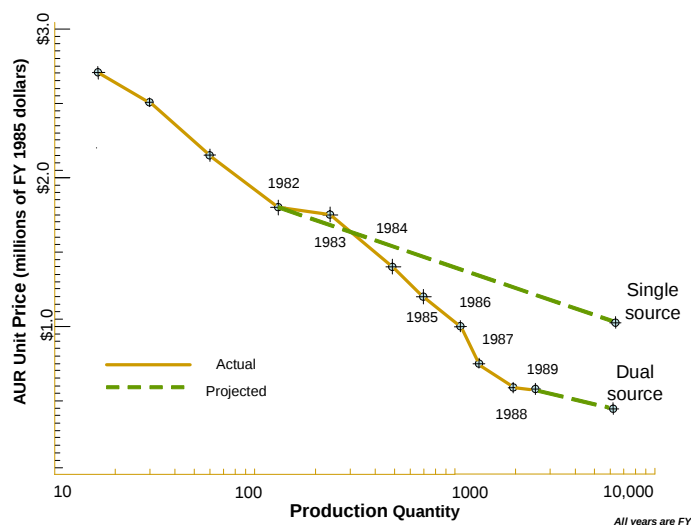
Tomahawk

The Tomahawk experience is another good example of successful second-sourcing in the defense market. The Tomahawk missile, also known as the air-launched cruise missile (ALCM) and ground-launched cruise missile (GLCM) for the Air Force and sea-launched cruise missile (SLCM) for the Navy, initially began out of the Joint Cruise Missile Program Office (CMP) started up by the Navy. The purpose of this office was to capitalize on the prospects of joint research and development efforts and funding between the services to create a highly versatile missile that could be easily modified based upon the specific needs of the military branch.

Since the inception of the program, the CMP directed extensive use of dual-competitive sources for all major elements of the missiles. Several companies participated in the competition that included Williams International Corporation, Litton Guidance & Control Systems, Litton Systems Limited of Canada, General Dynamics/Convair Division (GD/C), and McDonnell Douglas (MDAC). GD/C and MDAC were particularly involved with the production and integration of the Tomahawk family of missiles. GD/C was the airframe producer and flight vehicle integrator, while the MDAC produced and integrated the guidance system (Birkler 1990).

To improve system reliability during the development, the CMP wanted to shift a large degree of responsibility for production quality of the overall missile to the manufactures; GD/C, however, was reluctant to warrant MDAC-produced guidance systems. In 1982, CMP decided to force an exchange of technology between the two companies and dual-source the All-Up Round (AUR), a flight-worthy Tomahawk missile contained in a launch-compatible canister and capsule. Thus, the two companies had to reciprocally transfer all necessary technology and negotiate the terms between themselves and the government. The related costs were recovered as a contract cost spread over the first 1,200 missiles produced by each company. Meanwhile, the government provided the two companies certain incentives to carry out the technology transfer effectively and quickly (Birkler 1990).

To encourage the exchange, each company was guaranteed a minimum of 30 percent of the annual buy, with the remaining 40 percent to be allocated depending on cost. The CMP awarded MDAC a directed buy of 36 airframes and 208 guidance sets and gave GD/C 208 airframes and 36 guidance sets for the first production year FY 1985. As demonstrated in Figure 11 below, dual-source production allowed for significant reduction in unit prices over time.



It was estimated that Tomahawk competition up through FY 1994 would save some \$630 million in then-year dollars, \$550 million in FY 1989 dollars, or \$270 million in discounted FY 1989 dollars (Naval Center of Cost Analysis 1989).

Due to the structure of the program, no government direct investment was required; instead, incentives were given to ensure contractors funded the technology-transfer costs and purchase of tooling and test equipment themselves. As a result of the competition, the Tomahawk's reliability also improved—from approximately 80 percent to 97 percent. Several studies on the subject, including one from the Office of the Secretary of Defense, concluded that dual-sourcing saved the government money after only three years of competition and significantly improved the overall performance of the system (Birkler 1990).

The success experienced by the Tomahawk dual-source production program occurred for several reasons, including:

- Low cost of second source entry: less than 2 percent of the projected production cost;
- Learning curve improvement: The original airframe producer, GD/C, initially projected a relatively flat learning curve, 91.6 percent, in its own studies. Virtually every other missile program has achieved a steeper slope, and GD/C showed later, under the spur of competition, that greater price reductions were achievable;
- Size of production: Production was large enough to absorb the fixed costs without distorting AUR unit costs unduly;
- Strong management and leadership: CMP was able to effectively ensure the competitive environment was maintained throughout the production (Birkler 1990).

Joint Strike Fighter

A current example of the potential benefits from competition during production can be seen in an analysis of the Joint Strike Fighter (JSF) acquisition. Again, like the Tomahawk, the JSF is a program intended for multi-role, inter-Service performance in the U.S. Air Force, Navy, and Marine Corps. Uniquely, the JSF is also a multinational program, with full partnership participation by the United Kingdom and involvement with other international parties.

The program attempts to employ one basic design of high commonality (over 70 percent) in structure and subsystems, core engine, and mission systems (avionics)—among multiple variants that include a conventional takeoff and landing (CTOL) variant, a short takeoff and vertical landing (STOVL) variant, and a carrier variant (CV). Due to the commonality across variants, acquisition and support is more efficient and, thus, more economical and cost effective. In 1996, the DoD used a compete-for-development strategy and selected the Boeing Company and Lockheed Martin as the JSF's two finalist prime contractors. DoD intended to grant one of them the right to develop and produce all variants of the JSF in fall 2001—a production of more than 3,000 aircraft, worth over \$300 billion in then-year dollars. Some five years later, the sole-source award for development and production was awarded to Lockheed Martin and noted to be the “best value” to the DoD (Tirpak 2002). With this decision, Lockheed Martin Corporation is likely to be the exclusive supplier of manned fighters to the U.S. military through the end of this decade.

During the award process, much deliberation was undertaken to address the question of whether or not this type of acquisition strategy (sole-sourced development and production) really offered the best value to the government. Although this “winner-take-all” approach has been the typical strategy employed by DoD to acquire major weapon systems, some officials were concerned that awarding the JSF to a single source would result in higher costs and less technological innovation as opposed to maintaining a robust competitive environment through the production.

Congress was reluctant to concentrate all manned fighter work with a single contractor facing no competition and had questioned the single-source development plan numerous times. In 2000, Congress asked the Pentagon three times to review the winner-take-all approach. Additionally, in 2000, the Under Secretary of Defense for Acquisition, Technology, and Logistics asked the RAND Institute to explore the feasibility of introducing competition during the production phase of the JSF. As a result, the prospect of dual-source development and production was explored. It was estimated that setting up a second production line for the JSF would cost between \$1 billion and \$4 billion. The RAND study devoted to the subject concluded that:

- Establishing a second production source would require a significant investment of non-recurring costs, which would not be fully recovered through the savings that would result from production competitions;
- The JSF program should consider competitive maintaining pressure at the subsystem level by supporting a second industry team to develop and produce the follow-on integrated mission equipment suite. This recommendation was based on the fact that a majority of the cost of the aircraft was in the subsystems (engines and electronics). Furthermore, RAND also found that approximately half of the electronics programs it examined that had two or more production sources achieved a 30 percent savings with competition (see Figure 12) (Birkler 2001c).

Savings Achieved	Electronics Programs
>0 %	10/10
>10 %	9/10
>20 %	7/10
>30 %	5/10
>40 %	4/10

Figure 12. Fraction of Electronics Programs Examined that Achieved Savings (Birkler 2001c)

Based on this analysis, DoD made the decision to dual-source the engines and the major avionics elements. However, cost pressures on the DoD and the JSF led to an initial sole-sourcing of the avionics (with the option of introducing competition later), and in 2004, the DoD (in a short-term, “cost saving” budget action) decided to drop the engine second source.⁸ As noted in Figure 13 below, dual-sourcing of the engines during production could have resulted in significant cost savings; however, the initial investment of nearly \$2.7 billion was viewed as too steep an investment.

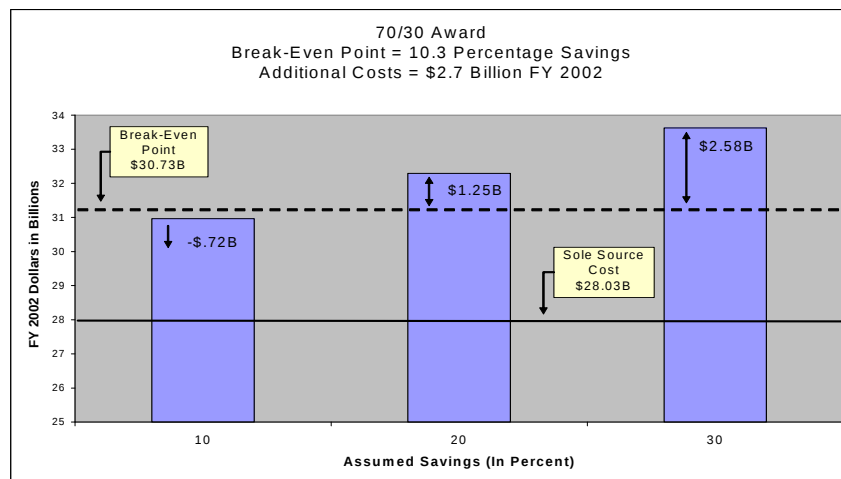


Figure 13. F-35 Engine Dual-source Estimated Savings (Sullivan 2007)

As these cases demonstrate, adding a second production source can increase the early program investment. However, the benefits from performance improvements and cost reductions can be significant over the lifecycle of the program.

⁸ The DoD’s decision to cancel the JSF alternative engine program came under significant criticism from the GAO (GAO-06-717R 2006) and some members of Congress.

Sole-source Awards

There are some unique circumstances when competition may not be appropriate. The *Federal Acquisition Regulations (FAR)* 6.3 explicitly identifies when a sole-source contract award can be justified:

1. Only one responsible source and no other supplies or services will satisfy agency requirements
2. Unusual and compelling urgency
3. Industrial mobilization, engineering, developmental or research capability, or expert services
4. International agreement
5. Authorized or required by statute
6. National security
7. Public interest

One timely example of a decision to use a sole-source came in response to an operational need, with the surge in casualties due to road-side bombs in Operation Iraqi Freedom. A sole-source contract was awarded to two firms for mine resistant vehicles and was easily justified based upon compelling urgency. However, after the initial capability was made available in theater, the Army continued to rely on the sole-source contracts. These follow-on sole-source contracts were plagued with cost increases and schedule delays. In 2007, the DoD Inspector General (IG) released an audit on the sole-source award of some 15 contracts to Force Protection, Inc., and Armor Holdings International for the purchase of mine resistant vehicles valued at over \$2.2 billion. After the audit, it was found that many other capable sources existed that were able to produce the vehicle. The report noted that the two sole-source contractors had little incentive to meet production schedules, since contracts for more vehicles continued to be awarded to them. For example, of the 122 JERRVs mine vehicles they produced, 120 or 98 percent were delivered late (United States Department of Defense 2007). This is a staggering statistic—especially given the fact that these vehicles were supposed to be procured quickly to support ongoing efforts in Iraq. Sole-source contract awards are important when the appropriate justification for their use can be made, **but these should be rare and limited.** The introduction of competition can provide the needed pressure to ensure efficiency and delivery schedule accuracy.

V. Competition and the Provision of Services

Cost savings, efficiency, and higher performance can not only be accomplished when competitive pressure is introduced into the acquisition of weapons systems by DoD, but for the provision of services as well. DoD contracts for a wide and complex range of services. These include professional, administrative, and management support; construction, repair, and maintenance; information technology services; research and development; medical services; operation of government-owned facilities; and transportation, travel, and relocation. Some of these are integral to weapon system acquisition or sustainment. But a large number also fall outside these categories. The area of greatest potential impact from competition are those services that are still performed in an inefficient monopolistic form—either sole-source to a commercial firm, or those services performed by DoD civilians and, in some cases, by military members.

Competition for Military Sustainment

One very significant type of competition for services is for the sustainment of military weapons systems. In FY 2006, DoD spent approximately \$162 billion on defense logistics and sustainment activities (Bell 2007). The performance, however, is still far from world class. Delivery times for warfighter material and equipment ranges from 16 to 33 days, with significant variability resulting in reduced long-term military readiness at a higher cost. The current DoD approach for cycling key equipment back to the U.S. for maintenance and repair is resulting in billions of dollars of assets backlogged through every stage of the process. Despite over ten years of investment in asset visibility technology, DoD has yet to achieve adequate asset tracking in supply delivery to theaters of war overseas or in bringing material for repair back to U.S. facilities. As a result, military readiness is degraded, and warfighter effectiveness is reduced.

This poor performance can, in large part, be attributed to traditional DoD sustainment strategies that focus on conducting business transactions to procure parts and services by using a “supply push” strategy in hopes of ensuring maximum availability of required spares and replacement parts. To accomplish this task, the military had to estimate the

requirements, then procure, store, and when required, ship the necessary parts. This supply model is highly dependent upon having large inventories and is often referred to as the “just in case” system. This approach, however, created perverse incentives for the Original Equipment Manufacturers (OEMs) that usually had sole-source, follow-on support contracts, because their profits were based on the volume of parts being sold, and not the availability or readiness of a system they were supporting.

As a result of the inefficiency that existed with this legacy sustainment approach, DoD introduced and encouraged the use of the support strategy known as Performance-based Logistics (PBL), i.e., buying outcomes or military readiness. PBL may be used at the system, subsystem, major assembly level. PBL shifts the focus of the government’s efforts from transactions (such as maintaining a minimum level of inventory) to the identification of performance outcomes (such as requiring that a system is available a certain percentage of the time) and the assignment of responsibilities to either contractors or government personnel.

PBL requires active management of the sustainment process through forecasting demand, maintaining inventory, and scheduling repairs. With PBL, the responsibility for the completion of these tasks lies with the support provider, not the military—thus creating an incentive (via profits) for ensuring systems (or services) maintain high levels of availability. The shifting of responsibilities from the military to the support provider creates a better support environment for DoD, which is seeking to maximize system availability while minimizing costs and the logistics footprint.

One specific example of the improvement from PBL can be seen in the sustainment of the Navy’s F/A-18 E/F. This PBL program created a virtual program office that served as a centralized coordination office for government stakeholders and private industry to provide sustainment at the sub-system level for the Navy’s Hornet aircraft. Once a contract was put in place that incentivized the contractors to provide a high level of system availability, the readiness improved dramatically (from 57 percent in 2000 to 73 percent in 2005), while costs were reduced and stabilized (with a savings of over \$100 million in the current contract through 2010) (Gansler 2006). Another example is with

the Air Force's KC-135 tanker fleet. In FY 2000, some 32 percent of KC-135's were unavailable due to the traditional depot maintenance system of support. By introducing competitive PBL, maintenance days were reduced by 19 percent, with costs reduced by some 15 percent per aircraft (Kratz 2008).

It is important to note that PBL is most effective in a continuously competitive environment in which support opportunities are re-competed often to allow for maximum competitive pressure on the supporting firms. As demonstrated in Figure 14 below, several examples exist in which traditional sustainment support for weapons systems was replaced using a competitively awarded PBL model. These results demonstrate the potential for the significant improvement in performance by using this strategy.

Navy Program	Material Availability		Logistics Response Time	
	Pre-PBL	Post-PBL	Pre-PBL	Post-PBL
F-14 Lantirn	73%	90%	56.9 Days	5 Days
H-60 Avionics	71%	85%	52.7 Days	8 Days
F-18 Stores Mgmt. System	65%	98%	42.6 Days	2 Days CONUS 7 Days OCONUS
Tires	81%	98%	28.9 Days	2 Days CONUS 4 Days OCONUS
APU	65%	90%	35 Days	6.5 Days

Figure 14. Sustainment Availability and Response Time Pre-PBL and Post-PBL (Klevan 2005; Kratz 2004)

Competitively awarded PBL contracts have established dramatic improvements in material availability (above 95 percent), world class response times (2-4 days), significant reductions in inventory, and savings of 17 percent over the historic support methods. The further expansion of this practice could significantly improve availability and readiness for the warfighter, with considerable savings.

Competition for Services

Cost savings, efficiency and higher performance can be accomplished not only when competitive pressure is introduced into the acquisition of weapons systems by DoD, but also for the provision of services as well. Just like competition for systems, on the service side, competition can exist at two different levels. The first level of competition can exist

in the initial competition *for* the services. Much like competition for production, this type of competition is mostly about the lowest bottom line, which, for the purposes of the bid, often equates to the lowest hourly rate, with little accountability for quality of the service. In this case, when an award for a service contract is made, the sole-source nature of the award allows the provider to become relaxed during the execution period and does not require the provider to seek greater efficiency, quality and lower labor rates over the course of the contract.

Perhaps one of the most notable examples of competition for the provision of services can be seen in the Logistics Civil Augmentation Program (LOGCAP). This program requires contractors to provide the Army world-wide sustainment and support by completing numerous functions such as providing housing, meals, cleaning, or transportation. Current support responsibilities include Multinational Force-Iraq and a host of various U.S. Government civilian agencies such as the Iraqi Survey Group, Coalition Provisional Authority, Threat Analysis Agency and the U.S. Department of State, Afghanistan, and around the globe. In the Post 9-11 era, the contractors working under LOGCAP have supplied support with over 34,000 contracted employees at an estimated cost of \$12 billion. Most notably, a majority of the services being provided under LOGCAP are under harsh and hostile conditions, a feat considered within the defense community and Pentagon by many to be unparalleled (United States Army 2008).

The LOGCAP support program has been competed four previous times. Because each of these LOGCAP awards were very large (in both volume of work and dollar amount), they were highly contested. For LOGCAP I, II, and III however, the competition only occurred for the provision of support services. Awarded in December 2001, LOGCAP III, (as of July 2007, total contract value of \$23.4 billion) was a single Indefinite Delivery/Indefinite Quantity (ID/IQ) cost plus award fee contract awarded to Kellogg, Brown, and Root (KBR) (a one-year contract with nine one-year options) (Thompson 2006). After the competition had been won by KBR, all services would be performed by only one contractor, with no competitive pressure to ensure the best prices were being given or that performance standards remained high—during the period of performance

there was an effective monopoly. Furthermore, there was a public perception of inappropriateness, even though the initial contract awards were the result of competition.

Competition during the Provision of Services

With competition *during* the provision of services, competitive forces are at play, with rates and efficiency challenged throughout the period of performance by several qualified service providers. Then, each individual task order can be competed. Using this type of competition allows the government to identify the best qualified providers upfront. Once a core group of service providers is selected, each task order under the umbrella ID/IQ contract can be competed. As a firm loses one task order, the incentive to win the next task order will pressure the losing firm to lower prices or increase efficiency. Because of these advantages, the previously mentioned LOGCAP III contract was not renewed in the fifth option year, and the Army decided to re-compete the effort under what would be known as LOGCAP IV. For LOGCAP IV, awards to three firms were made. While these initial three awards do not provide any specific dollar amounts for the work to be performed, they do “pre-qualify” the firms to bid on the individual support task orders as they come up. By re-competing the contract often, and at the task order level, DoD can benefit from the best prices and take advantage of the pressures from competition, while ensuring that only qualified offerors are considered.

Competition for Government Commercial Activities

Background

It has always been the long-stated U.S. federal economic policy that the government will not produce products or provide services that are available in the private sector. The American public, however, has increasingly asked government at all levels to provide more and more services. As these services increased, so did the number of government employees. The underlying assumption was that government-sponsored functions should be performed by government employees, resulting in the build-up of large government bureaucracies. This was equally true within the DoD, in which many non-military functions (such as grass cutting, building maintenance, construction) were routinely performed by military servicemen and civilian employees.

Beginning in the 1980s, the assumption that government services must be carried out by government workers has been questioned. This began first at the state and local level, where people asked, “Why is driving a bus an inherently governmental job? What would happen if it was competitively awarded to private-sector firms?” In an effort to meet tight budgets, city council members and local mayors thus attempted to implement competitions for this work. They tried a variety of techniques, to include allowing private-sector competition for the work among firms that specialized in that business; competing the work between the current government employees and the private sector; and in some cases the work was simply privatized by letting private companies bid for the government capital equipment and employees. Figure 15 shows that cost savings ranging from 20% to 60% resulted (compared to the costs of non-competitive services that were replaced), while performance improved (Savas 2000).

City	Year	Performance Improvement
Denver	88-95	Service levels increased 26%
San Diego	79-96	Service levels increased 47%
Indianapolis	94-96	Service levels increased 38%
Las Vegas	93-94	Service levels increased 243%
Los Angeles	80-96	Service reliability increased 300%, complaints reduced by 75%

Figure 15. Public vs. Private Competition for Services: Performance Improvements 1st—Then Cost Savings (Savas 2000)

Although the results of these initiatives were positive, there was, of course, resistance from government workers, their unions, and their political representatives. While this concept was catching on widely at the state and local levels in the 1980s and early 1990s, it was not until the mid-1990s—led by the Department of Defense—that there was widespread consideration of this approach taking hold at the federal level.

Competitive Sourcing

Over time, the DoD has become increasingly interested in allowing the private sector to compete to provide services that are peripheral to the Department’s core mission, while only retaining in-house those functions that require performance by government civil service or uniformed personnel. Using the processes outlined in Office of Management

and Budget's (OMB's) *Circular A-76* via competitive sourcing, in-house functions—including personnel, administrative, engineering, logistics, base and post operations, training, and related support functions in all Military Services—can be retained while being more cost efficient and improving performance.

Competitive sourcing occurs when a private sector firm and a government service provider compete to perform commercial activities currently performed by government employees. A commercial activity is defined by *OMB circular A-76* (which controls the competitive sourcing process) as a product or service currently provided by the federal government that could readily be provided by a private-sector source. The circular specifies the procedures that the DoD (as well as all other federal executive agencies) must use to evaluate whether these commercial activities should be performed by government sources, private-sector sources, or possibly by another federal agency through an “Inter-Service Support Agreement” (Office of Management and Budget 2003).

Competitive sourcing is distinctly different from other sourcing options that assume that the private sector can provide less costly, higher quality services than the public sector. Competitive sourcing assumes that competition between the two providers leads to improved quality at lower cost—regardless of which sector is the winner (Gansler 2003). Just as the private sector would prepare a bid for a job, the targeted government employees form an entity, known as the Most Efficient Organization (MEO), to prepare a proposal; the proposals are evaluated with either the lowest cost provider or best value to the government used as the selection criteria.

The data below shows that the benefits of these competitions are significant, with a demonstrated average cost savings of approximately 30% using *A-76* competitions while maintaining, at a minimum, the same level of performance (see Figure 16).

	Competitions Completed	Average Annual Savings (\$M)	Percent Savings
Army	510	\$470	27%
Air Force	733	\$560	36%
Marine Corps	39	\$23	34%
Navy	806	\$411	30%
Defense Agencies	50	\$13	38%
Total	2,138	\$1,478	31%

Figure 16. Results of Public/Private Competitions 1978 - 1994 (Office of the Secretary of Defense 1997)

A more recent study examined the competitions won by either the in-house MEO or private contractors. The MEO FTE proposed illustrates how introducing competitive forces can drive gains in productivity and efficiency in government operations—even when the government wins. The difference between the total number of authorizations studied and the final average MEO full-time equivalents (FTEs) was large. As could be expected, those MEO proposals that won had the largest reduction of positions, with a 47 percent decrease from total authorizations. The MEO proposals that lost did not have as large a reduction, but even these proposed 28 percent fewer FTEs—to perform the same tasks as were being currently performed (Gansler 2004a).

Winning Bidder	Number of Competitions Won	Civilian Positions Competed (Excluding Direct Conversions)	MEO FTEs* (Excluding Direct Conversions)	% Decrease from Civilian Authorizations to Government MEO FTEs
In-House	525 (44%)	41,793	23,253	44%
Contractor	667 (56%)	23,364	16,848	28%
Total	1,192	65,157	40,101	38%

*MEO= Most Efficient Organization (as proposed by government workers)

Figure 17. DoD “Competitive Sourcing” Demonstrated Results 1994 – 2003.

Benefits from the A-76 competitions have included better performance at a lower cost, a “leaning” of existing government processes, and the creation of competition in a market (government-provided services) which is usually immune from such forces; the results ultimately amount to better services for the tax payer.

These results were not unique to the DoD; two particularly dramatic examples of the “art of the possible” resulted from competitions held by the Internal Revenue Service (IRS). The IRS competed two large functions:

- **Area Distribution Centers.** The IRS maintained three Area Distribution Centers (ADCs)—the Central Area Distribution Center in Bloomington, Illinois; the Eastern Area Distribution Center in Richmond, Virginia; and the Western Area Distribution Center in Rancho Cordova, California—to handle public and internal requests for published products. The IRS chose to package and compete the work performed at the ADCs in a single competition.
- **Campus Operations and Support.** A service that supplies all services, materials, supplies, facilities, supervision, labor, and equipment to perform Campus Center Operations at the 10 centers around the country.

	<i>Number of FTEs Competed</i>	<i>Winner</i>	<i>FTEs Proposed</i>	<i>Reduction</i>
<i>Area Distribution Centers</i>	<i>400</i>	<i>MEO</i>	<i>160</i>	<i>60%</i>
<i>Campus Center Operations and Support</i>	<i>278</i>	<i>MEO</i>	<i>60</i>	<i>78%</i>

Figure 18. Competitive Sourcing 2004 IRS Results

The results, shown in Figure 18, are dramatic. The MEO’s won both competitions with FTE reductions of 60 and 78 percent respectively (Gansler 2004c).

Long Term Savings

One of the major concerns with competitive sourcing is that the savings will not be realized. The Center for Naval Analysis (CNA) conducted a study that examined the actual (realized) savings from the DoD competitive sourcing after the work has been completed. The results of the study, comparing the actual realized savings with the expected savings, are illustrated in Figure 19. For the sample of 16 competitions, the analysis indicated the savings were, in fact, realized over time. The expected savings

were 35 percent, and the effective savings rate was remarkably close—34 percent; the savings did not diminish over the solicitation period. When all wage, scope, and workload changes are included, the observed savings rate of 24 percent was observed. The savings are real and are sustained over time (Clark 2001b).

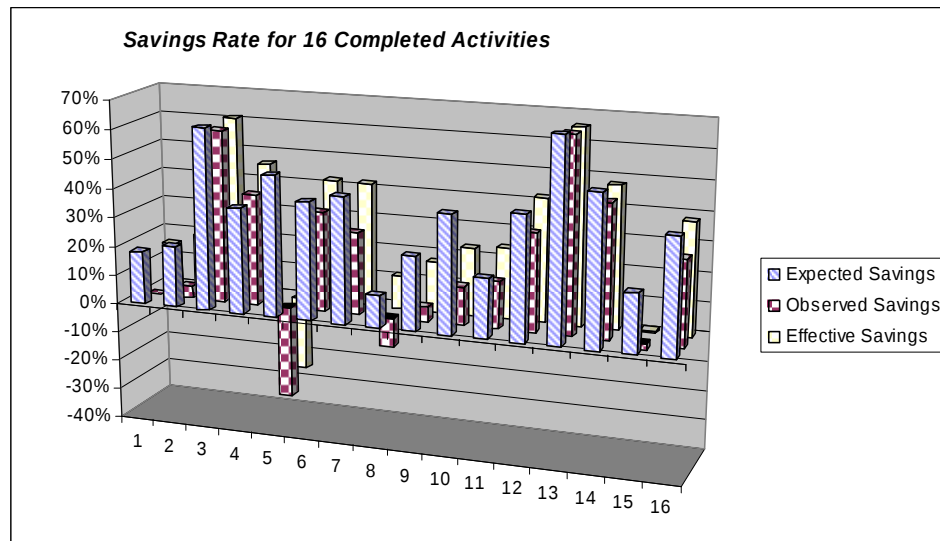


Figure 19. Expected, Observed and Effective Savings from A-76 Competitions (Clark 2001a)

As these results demonstrate, competitive sourcing has been very successful in improving the efficiency of the provision of services within the DoD. The introduction of competition (vs. prior monopoly) could serve to immensely aid DoD in achieving its future cost-savings goals (30 percent is a conservative estimate), while exceeding existing performance requirements (performance is found to improve, or at minimum stay the same, after the competitions). At the same time, competitive sourcing allows the organic government workforce an opportunity to bid to retain the work, as opposed to other strategies such as outsourcing or privatization. In spite of these successes, competitive sourcing continues to meet with stiff resistance from employee labor unions, which often results in Congressional restrictions. Congress, which takes a dim view of this strategy, has passed a variety of restrictions, usually aimed at specific agencies. Two examples that directly impact the DoD are listed below.

1. *FY 2006 Defense Authorization Act* permanently codifies the restriction for DoD's use of best-value tradeoff competitions in Title 10. Before they were

banned, both cost and quality (as opposed to just cost alone) could be taken into account in selecting a provider. Using this “best value” criterion produced an expected savings of \$68,000 per FTE; this was three times the average expected net savings from all competitions (Office of Management and Budget 2008).

2. The *Defense Appropriations Act, FY 2007* imposes constraints on the manner in which private contractors competing for defense work may provide health care to their employees and prescribes a minimal amount of health care to be provided. The effect is to create a disincentive for the private sector, especially small businesses, to compete for defense work and eliminates incentives for contractors to provide cost-effective health benefits, such as through health savings and medical savings accounts.

We believe savings and performance improvements made possible through public-private competition would be even greater if Congress eliminated these restrictions that currently limit the reasoned use of public-private competition. However, even with these restrictions, from FY 2003 through 2007, DoD managed to compete a total of 20,520 FTE's, with a projected net savings of \$1.8 billion during the performance period (Office of Management and Budget 2008). In addition to competitive sourcing, it should be noted that other mechanisms of competing government commercial activities do exist. They include:

- ***Competitive Outsourcing***

Outsourcing occurs if the DoD looks to the private sector for more efficiency, higher performance and lower costs than is currently being provided by existing government personnel. In this case, outsourcing is only competed between the potential private firms seeking the contract. Examples of outsourcing have been prevalent in the private sector, as firms that provide customer-service-based operations via computers or telephones are able to hire labor to carry out these functions anywhere around the world. Often, this enables firms to achieve the same and/or better customer satisfaction at significantly lower costs. The competitive outsourcing of desktop services at NASA, for example, improved service delivery, availability and customer

satisfaction (Gansler 2004b). The use of outsourcing for existing functions is limited, since the A-76 process must be used.

- ***Privatization***

Privatization means the work (labor) and assets (facilities) are turned over by the Defense Department to be controlled and operated by the private sector. Privatization is management focused as opposed to being workforce focused. With privatization, the private sector comes in to manage resources more effectively in hopes of generating greater efficiency and performance effectiveness. Much like outsourcing, once the privatization process is complete, basically no competitive pressure exists to force the firm to improve. In the mid 1990s, several large military depots, such as Kelly Air Force Base, McClellan Air Force Base, and the Sacramento Army Depot, were privatized in an effort to reduce DoD's excess capacity. One such case of success for privatization occurred at the Louisville, KY Naval Depot. The Navy estimated that the cost of closing Louisville and transferring the work to other naval facilities around the country would cost approximately \$302 million, while comparatively, the privatization-in-place option would cost some \$132 million—\$170 million less. Ultimately, by implementing privatization, DoD improved delivery performance and decreased defects significantly (Lucyshyn 2005).

- ***Public-Private Partnerships***

A limited model of privatization can be found in the form of public-private partnerships. Public-private partnerships in the service arena occur if both sectors (the government and private industry) agree to share the costs, risks, benefits, and profits associated with completing the activity together. In the case of public-private partnerships, everything from production to management to investments is shared by both parties, and the opportunity for a partnership may either be sole-sourced or competed by the government among private firms. One example of a successful public-private partnership is the Robins Air Force Base C-130 engine maintenance project, which was the first prime-vendor-type partnership to be used on a major weapons system. The prime-vendor model incentivizes the private firm to maintain

specific levels of part availability and optimize delivery turn around time to the government. For the C-130 engine maintenance program, 99.4 percent of routine orders were shipped to the base within 8 days, while 97.8 percent of expedited orders were fulfilled within only 2 days. As a result of this program, on-site inventory was reduced some 98 percent—saving the government over \$11.7 million in inventory costs (Gansler 2004b).

VI. Recommendations and Conclusions

The benefits of competition are well established. The available evidence supports that competition will:

- Encourage innovation and higher quality,
- Reduce production cost significantly,
- Reduce lifecycle costs significantly,
- Reduce cost growth throughout the program,
- Strengthen the industrial base, and
- Improve the quality of services.

Although competitive practices are frequently implemented within the DoD, the practice is not being maximized. The breadth of this implementation varies by service and often by the type of requirement being acquired. Competition must also be maximized during all phases of acquisition and must be included during pre-planning phases as a minimum requirement for a program to proceed. Specifically, we make the following recommendations:

Recommendations

Utilize Competition during All Phases of the Acquisition Process

Competition, built in from the beginning of acquisition planning, is critical to ensure that its benefits can be harnessed throughout the process. Because of the current phased design and development requirements for system acquisition, natural cutoff points exist for competition to be introduced to the process. Competition is largely accepted at the initiation of development and for production. Competition during production, however, is often resisted—even though it is the key to ensuring a real incentive exists for contractors to ensure they meet cost, schedule, and performance requirements. As the data we examined showed, the level of cost savings that can be achieved with

competition at this level can be significant and should be encouraged in all its various forms and options. DoD needs to ensure the funds for dual-source production are made available when the development and planning process begins and that the necessary oversight and management structure exists to support a dual-production environment across the Services. These are the two most important factors that determine if a dual-source production can occur and be successful. In those special cases in which dual-source production may not be practical, as long as the single source continues to improve performance and lower costs, the vendor should be rewarded with the follow-on contract. However, the option for competition should, if at all possible, be maintained and used if that standard is not achieved.

Competition during support, when possible using performance-based logistics, should be expanded across DoD programs. There is the potential to significantly lower the total ownership costs, which can free-up needed funds for force modernization. Within the approximate \$170 billion logistics budget, performance improvements are required, and savings are significant.

Competition for services is unique from other types of competitions for programs. Because of the various types of service competitions and sources that are available, agencies and departments within DoD need to understand the costs and benefits of each prior to making a determination. Again, the benefits from competition for services are tremendous, and much flexibility is available in exactly how the services are provided and who provides them. The important factor is to provide an incentive for those giving the services to be efficient and productive.

Expand Defense Industrial Base

With many defense firms shifting their focus to the commercial sector or serving other government customers, DoD must develop a strategy to encourage firms to continue to remain in the defense business.

Ensure the Competitiveness at the Prime Level and Sub-Tier Levels

DoD must continue to review and evaluate the impacts of potential mergers and acquisitions, with a goal of maintaining at least two viable suppliers in mature defense markets. In some cases, this may mean the award of development contracts (with no immediate intent for production) so that the primes can maintain their design and integration skills. In areas that require innovation or with exceptionally high demand, a greater number of suppliers should be maintained. The goal must be to maintain a competitive environment, and, at the same time, to discourage anti-competitive horizontal or vertical consolidation.

Incentivize Firms to Enter Defense Business

In addition, the DoD must take a leadership role to remove the many barriers that prevent non-traditional firms from entering the defense business sector. This effort should be aimed at accepted rules, regulations, and practices within the defense market that often create barriers to entry. Reducing these obstacles will allow the DoD to increase competition by reaching beyond the traditional defense companies, as well as to seek transformational technologies and services.

Expand the Small Business Innovation Research (SBIR) Program

With the consolidating industrial base, the anticipated downward budgetary pressure, and less industry investment in R&D, where will competitive pressure and innovation come from? The DoD's Small Business Innovation Research (SBIR) program⁹ has proven to be very successful in attracting new entrants in the defense industry, resulting in the formation of many new, innovative companies.

⁹ The Small Business Innovation Research (SBIR) program was created in 1982 through the *Small Business Innovation Development Act* (Public Law 106-554). DoD is the home of the largest SBIR program, which funds early-stage R&D at small technology companies and is designed to: stimulate technological innovation, increase private-sector commercialization of federal R&D, increase small business participation in federally funded R&D, and foster participation by minority and disadvantaged firms in technological innovation.

Reduce Horizontal and Vertical Integration

The government must continue to monitor and resist the horizontal integration of defense firms; the government should especially not allow consolidation from two firms to one (i.e., from an oligopoly to a monopoly) in any critical defense sector.

The same should hold true in any critical sub-tier (not so much because of anticompetitive considerations at the prime contractor level, but primarily because of vertical-integration considerations). Specifically, the concern regarding vertical-integration is that if one prime owned the only (or even the acknowledged best) supplier of a critical subsystem that would put it at a very significant competitive advantage against other primes; the others would not (as a result of the merger or acquisition) have access to that subsystem supplier on future, large weapon-system bids. Although the primes proposing the merger or acquisition of the lower-tier supplier usually argue that their subsystem division would be a “merchant supplier” to anyone bidding against them, this argument is not very credible. This issue of “vertical integration” creates another problem: how does the government assure that its selected prime contractor has picked the best of the possible subcontract suppliers, rather than the subcontractor that is now part of its own company? In fact, this concern has forced the government to get much more involved with the prime contractor’s “make or buy” decisions (on major subsystems and critical-components) than it has in the past.

Where Possible, Reduce the Government Monopoly

DoD should introduce competition into commercial activities currently performed by civilian employees or military service members—i.e., all those functions that are not inherently governmental. It is clear from all the available data that when competition is introduced, government service improves, and costs generally decrease significantly. The key is shifting from a monopoly to a competitive environment. The goal must always be to get better performance at a lower cost. Privatization, competitive outsourcing, and public-private partnerships can also be used as alternative methods for introducing competition, and depending upon the context, they can also be successful in improving performance and reducing costs.

Take Advantage of Globalization

DoD must recognize the benefits from embracing the benefits of globalization for the purposes of enhancing competition in defense acquisitions. First, the distinction of the country of origin is, in large part, artificial. At the parts-supplier level, essentially all U.S. weapon systems are already increasingly dependent upon parts from off-shore (for example, semiconductors from Japan, precision glass from Germany, etc.). This is being driven primarily because of the higher performance of these foreign sources, but also because of their lower costs. Second, consistent with the commercial industry globalization trend, as well as the rapid global spread of technology in the information age, the major defense industrial firms (on both sides of the Atlantic) begin to aggressively enter each other's market—often in transatlantic partnerships and frequently through acquisitions. The most notable of these was the aggressive U.S. acquisition program of BAE Systems (the dominant U.K. defense firm)—first buying Tracor, then Sanders, and, most recently, United Defense. These specialized firms, former “crown jewels” of the U.S. defense industrial base, are now part of BAE Systems (a “U.K.-headquartered firm” with a separate board of directors for U.S. operations), one of only six remaining U.S.-based, major defense contractors.

As a result, a more global defense industrial base (that includes firms based within close allies) is becoming more critical for the U.S. to maintain competitive pressure within the reduced defense industrial base. By globalizing in this way, with the appropriate security measures, the U.S. will be able to gain access to the most advanced military capabilities, as well as to help ensure markets for U.S.-based firms and to provide improved economies of scale. The goal is not to become dependent upon these sources, but to create additional competitive pressure. As international firms are added to the U.S. defense market, they will stimulate competition and force U.S. firms to become more efficient and to increase their performance and innovation.

Conclusions

Our recommendations are made with the understanding that several barriers must be accounted for and overcome in order for these recommendations to be successful. First,

the national security environment is likely to make long-term planning for programs difficult, as pressing needs will force DoD to try to procure goods and services quickly under the false pretense that such acquisitions can not be done via a competitive scenario. In these instances, some will make the case that such acquisitions must be sole-sourced. While there is indeed reasonable justification for such acquisitions in limited situations, non-competitive acquisition should be the exception and limited in duration when used. The consolidation of the Defense Industrial Base following the end of the Cold War significantly limited the ability of the DoD to take advantage of the natural competition of the marketplace, which must also be recognized and addressed. Finally, restrictions on globalized practices such as the *Buy American Act* or *Berry Amendment* severely limit DoD's ability to be efficient and cost effective in the procurement of even the most basic items needed on a day-to-day basis. All of these factors are potential roadblocks to enhancing competition and must be taken into account during planning to provide for enhanced competition within the Department.

Many different types of competition exist across DoD for both weapons systems and services. The issue we are drawing attention to is the use of specific competitive practices for the enhancement of innovation, efficiency, cost effectiveness, quality and performance. As DoD seeks to transform itself in the twenty-first century, it must embrace the advantages that come from expanding competition—competition must be the cornerstone of DoD's acquisition system. It is the stated law and is common in most speeches; it should be the common practice. The nation deserves no less.

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