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Bringing Acquisition Reform into Focus

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Abstract. The response of our defense industrial base to major changes, such as the collapse of the former Soviet Union, emphasize the need to continue to improve the way the United States buys weapon systems. By looking through a historical lens, this paper addresses predicting the long-term success of acquisition practices and reform initiatives for the cost community. A literature review identifies acquisition reform legislation and initiatives since World War II. Looking at past acquisition reform and their long term impacts leads to the conclusion that acquisition reform efforts must be viewed skeptically. Given a dynamic environment, estimating costs may actually be made more difficult by reform initiatives. Improvement in the acquisition of weapon systems requires fundamental change that emphasizes future implications, not just focusing on the present or past.

"This conjunction of an immense military establishment and a large arms industry is new in the American experience. . . We recognize the imperative need for

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this development. Yet we must not fail to comprehend its grave implications. . . In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist."

President Dwight D. Eisenhower, Farewell Address
January 17, 1961 (Beck 1980)

INTRODUCTION

President Eisenhower's concerns about the military-industrial complex reemphasized the need for continued scrutiny of how America acquires weapons. The goal of this paper involves predicting the long-term success of acquisition reform initiatives by looking through the prism of past practice.

At least two significant events over the last decade have shaped the defense landscape and our acquisition practices. The collapse of the Soviet threat, and our defense industrial base's response to it are both examples of unprecedented changes that rippled through every aspect of our defense system including the community of professional cost estimators. While the DoD acquisition system is perhaps the most studied, scrutinized, analyzed and criticized process in history, the intent of this paper is different. We intend to shed light on acquisition reform initiatives by bringing them into focus through a historical lens. By doing this, cost analysts will be better postured for developing more accurate cost estimates.

A literature review identifies relevant acquisition reform legislation and initiatives since World War II. In performing the review, two trends stand out. First, the foundation of acquisition procedures was established after World War II. This is reviewed to create a consistent foundation to view acquisition reform efforts over time. Second, reform efforts repeatedly focused on similar topics: contracting practices, concurrency, and competition. These ever-changing policies are specifically reviewed because they define critical elements of a weapon system program. After the review of each policy area, observations are made on the potential success of acquisition reform efforts in our unprecedented time of change and uncertainty, and their effect on the cost community.

FOUNDATION OF ACQUISITION AND REFORM

Acquisition reform began as early as 1808, when Congress passed a provision entitled "officials not to benefit" (Beryl 1995). One reason for reform is that acquisition programs are visible and quantifiable end products of an otherwise difficult to measure national security development process. Weapon system cost and schedule overruns, and performance

deficiencies are often publicized and lead to demands for reform. Initially mentioned in the 1986 Packard Commission, considering contractor past performance was mandated by the Federal Acquisition Streamlining Act of 1994 (Wright et al, 1998). Reviewing contractors' past performance assumes past success is correlated with future success. Applying this same standard to the government requires a thorough and objective review of the successes, failures and methods of acquisition reform efforts.

Our system acquisition process is the most visible step in the national security development process that supplies the weapon systems used by military forces to carry out national security goals. The purpose of weapon system acquisition is to provide the operational user with a capable, supportable and affordable system, when and where needed within cost constraints. The development and implementation of a national security strategy follows five interrelated steps:

1. Establishing national security goals;
2. Devising a military strategy to achieve national security goals;
3. Deciding what weapon systems are needed to carry out the selected military strategy;
4. Procuring identified weapon systems; and
5. Maintaining and upgrading weapon systems during their operational life (Burnett and Kovacic, 1989).

After the establishment of national security goals, each of the steps depends on the previous step for inputs. Additionally, there is feedback between the steps. For example, the development of the machine gun in World War I changed military tactics, trench warfare, which then prompted the development of the tank to break the stalemate.

Acquisition practices result largely from experiences in World War II. The mobilization effort of World War II and the following Cold War led to three fundamental characteristics of procurement:

1. The peacetime military would be large by pre-World War II standards;
2. Weapon systems capability would advance rapidly as technology advanced; and
3. Private-firms dedicated to defense products would design and produce weapon systems (Burnett and Kovacic, 1989).

Within this environment, the World War II procurement practices were formalized by the Procurement Act of 1947 (Kaufman 1996). Weapon system acquisition, since World War II, has been governed by the Procurement Act that essentially extended to peacetime the wartime powers granted to procurement officers.

The framework and practices underlying acquisition programs have remained consistent from the 1940's. Subsequent reform efforts have only increased the requirements

within the original framework. Given the changes in threat and industrial capability with the end of the Cold War, this foundation might not provide an adequate base for future acquisition reform initiatives. Attention is now turned to how policies have changed since the 1940's in regard to contracting practices, concurrency, and competition.

Contracting Practices

There have been basically two changes in contracting practices from World War II to the present. The first involved a significant change in who financed facilities expansion. Unlike the 1940's, where the government financed expansion, during the 1950's and beyond industry paid for new facilities. However, defense contractors were able to amortize their investment over five years under the Defense Production Act of 1950 (Day 1968). This is because some of the WWII production facilities were obsolete, but still considered excess capacity by the government. Placing the burden to expand facilities on defense contractors led to a shortage of production capacity (Day 1968).

The second change in contracting practices has been a cyclical pattern in the government's preference for either fixed-price or cost-plus contracts. Fixed-price contracts place the risk on the contractor, while cost-plus contracts allow the government and contractor to share program risk. Although cost-plus a percentage of realized cost contracts were abolished under the Procurement Act of 1947, during the 1950's cost-plus estimated cost contracts were used for both development and production (Przemieniecki 1993). In the early 1960's, Secretary of Defense Robert McNamara's implementation of several reforms included the continued use of incentive contracting (Przemieniecki 1993).

However, in the mid-1960's, the "Total Procurement" concept evolved to avoid problems with McNamara "paper studies" that focused only on front-end procurement costs (Foote 1986). The objective of Total Procurement was to transfer more risk to defense contractors by competitively bidding fixed-price contracts over development and production phases of a system (Foote 1986). The perceived advantages of the approach for the government included avoiding "low ball" bidding of development contracts, and obtaining production price commitments from contractors on items in development. The focus on awarding more fixed price contracts resulted in a reduction of cost-plus fixed fee (CPFF) contracts from the most common pricing arrangement to less than 5% of Air Force procurement dollars by 1966 (Brunner and Hall, 1968). A July 1969 memorandum by Deputy Secretary of Defense David Packard advocated cost incentive contracts for development and fixed-price contracts for production (Foote 1986). This guidance appears to have remained consistent until the 1980's.

Emphasis changed at the beginning of the 1980's, when the focus was on fixed-price contracts for all phases of a program. The use of a fixed-price contract proved to be a mistake on the AMRAAM development contract (Ropelewski 1985). Awarded in 1981, the AMRAAM contract experienced significant cost growth and schedule delays that led

to a complete restructuring of the program in 1985 (Ropelewski 1985). The award of a fixed-price contract on the AMRAAM development contract appears to contradict one of Deputy Secretary of Defense Frank Carlucci's original initiatives. Secretary Carlucci's Eighth Initiative, released on 30 April 1981, called for assuring the use of the appropriate contract type (Munehika 1997).

Flexibility in contracting method is more appropriate than emphasizing the use of one technique over the other. Fixed-price contracts are more appropriate where costs are either known or easily predicted. Cost-plus contracts are more appropriate where costs are uncertain, or with research and development contracts.

Use of Concurrency

The term concurrency was first used in 1958 to describe Major General Schriever's overlapping of development with flight tests used to produce the first ICBM (Foote 1986). However, the overlap of acquisition phases had been used earlier with mixed success. Post-World War II acquisition of aircraft experienced either delayed production of needed technology, or accelerated production that required later modifications (Foote 1986). An example of the first problem involved a two-year slip in production for F-84F aircraft, and an example of the second is B-47 aircraft moving directly from the production line to a modification line (Foote 1986). These problems led to the establishment of the "Cook-Cragie" concept in the mid-1950's to limit production 18-24 months until testing was complete (Foote 1986). This led to a better definition in the sequence of acquisition program events.

However, ballistic missile programs were treated differently. In May 1954, the Teapot Committee recommended to the Secretary of the Air Force that ICBM programs be accelerated (Foote 1986). This led to Air Research and Development Command being directed to establish an organization exercising overall responsibility and authority for the ICBM programs. Ballistic Missile Division (BMD) thus was established in Inglewood, CA (Foote 1986). The "special" status of ballistic missile programs reduced headquarters' oversight and allowed faster progress. For example, eleven months after BMD received go ahead, the first Thor missile came off the production line (Foote 1986).

Concurrency was used less in the 1960's as Secretary of Defense Robert McNamara's reforms focused on the sequencing of decisions, development, and production phases (Perry 1975). In 1969, a memorandum by Deputy Secretary of Defense David Packard ended concurrency in programs and resurrected 1950's prototyping by requiring a "fly-before-buy" milestone (Foote 1986). The 1970 Fitzhugh Commission also advocated deferring production decisions until after the successful demonstration of prototypes (Foote 1986). Prototyping was viewed as an inexpensive means to test technical feasibility. In light of this, it was relatively controversial that the F-15 development contract was awarded without a fly-off on 23 December 1969 (*Aviation Week* 1970). Additionally, the F-15 program started low rate initial production (LRIP) before completion of engineering, manufacturing, and

development (EMD) in March 1971 (Foote 1986). These events are even more surprising considering the publication of more anti-concurrency direction only months later, when Deputy Secretary of Defense David Packard created DoD Directive 5000.1, Acquisition of Major Defense Systems, in July 1971 (Przemieniecki 1993). The 5000 series directives established clearer guidance on acquisition, including reduced concurrency, and provided program managers both greater authority and accountability.

The success of the F-15 program boosted support for concurrency. In 1975 testimony before the Subcommittee on Federal Spending Practices, Efficiency, and Open Government, Robert Perry (1975) pointed to use of an incremental strategy in acquisition programs as one of the factors causing cost overruns. The 1978 Defense Science Board report on the acquisition cycle concluded the acquisition process had gone to unreasonable limits to discourage concurrency in programs and resulted in a rewrite of the 5000 series directives to remove anti-concurrency bias (Foote 1986).

This policy changed again in favor of prototyping during the 1980's. One of the features identified by the Packard Commission in 1986 of successful acquisition programs was the use of prototypes and testing (Munehika 1997). The DoD Appropriations Act of 1987 required the use a "competitive prototype program strategy" in developing major weapon systems (Burnett and Kovacic, 1989). The goal of mandated prototypes was to reduce technical uncertainty and refine manufacturing requirements and cost estimates.

The emphasis on prototyping continued in the 1990s with the exception of accelerated programs for Desert Storm. Operation Desert Storm in 1991, the first large scale use of contemporary weapon systems, required almost real-time upgrading of existing systems, accelerating the delivery of systems still in development and even fielding new capabilities. Perhaps the greatest success story of this "Accelerated Acquisition Process" was the GBU-28. This smart hard target penetrator was conceived, produced and delivered literally warm to the touch in only 28 days (Schoonover 1994). However, continued emphasis on prototyping is contained in the Information Technology Management Reform Act of 1996 that authorizes incremental acquisition and pilot programs for acquisition of information technology (ACQ201 1998). The current policy of supporting prototyping runs counter to evidence that prototyping leads to cost growth on programs while not decreasing the length of programs (Drezner, et al, 1993, and Drezner and Smith, 1990).

Instead of an emphasis on concurrency or sequential phases, a more balanced approach that considers the challenges of individual programs may be more appropriate. Programs viewed with high technical risk should follow a more sequential path, while low risk programs could experience low rate production until remaining uncertainty is minimized.

Emphasis on Competition

Competition policy changed during the 1960's. In the early 1960's, the bulk of procurement dollars were expended through non-competitive follow-on contracts (Brunner and

Hall, 1968). Then, during the mid-1960's, the Total Procurement concept attempted to transfer more risk to defense contractors by competitively bidding fixed price contracts over both development and production phases of a system (Foote 1986). Emphasis on competition had unexpected and undesirable impacts.

Increased emphasis on competition in the 1960's led to concern about contractor's use of "low balling" to win contracts. During the 1970's, excessive emphasis on competition caused defense contractors to be overly optimistic in their projections of program cost, schedule, and performance (Gates and Vernon, 1987). One reason for this is that as the Vietnam War ended fewer contracts were written. This meant the stakes to defense firms in the few remaining large competitions increased as winning became more important to their continued survival.

Competition, cited as a concern in the 1970's, was viewed as a solution during the 1980's. Deputy Secretary of Defense Frank Carlucci added another initiative to his original thirty-two in July 1981 with the goal of increasing competition (Munehika 1997). Congress required the creation of the Office of the Competition Advocate to promote the use of competitive contracting in the DoD, in 1982 (Burnett and Kovacic, 1989). Additionally, one of the recommendations of the Grace Commission, in 1984, was to increase the use of dual sources throughout the life of the program (Munehika 1997). The Packard Commission echoed the call for more competition.

The Packard Commission's formula for action in 1986 recommended the increased use of competition (Munehika 1997). This recommendation was also legislated. The DoD Appropriations Act of 1986 barred weapon systems from entering full-scale development without the Secretary of Defense providing Congress an "acquisition strategy" that provides for competitive alternative sources for the system and each major subsystem from the beginning of full-scale development to the end of production (Burnett and Kovacic, 1989). This emphasis on competition represented a large change in the acquisition of weapon systems. Exceptions to requirements for competition usually involved determining mandated competition "increased total program costs without commensurate, offsetting benefits" (Burnett and Kovacic, 1989). The emphasis on competition was extended by the DoD Appropriations Act of 1987 that required the use a "competitive prototype program strategy" in developing major weapon systems (Burnett and Kovacic, 1989).

In 1993, then Deputy Secretary of Defense William Perry held a meeting with defense executives and told them declining defense spending required defense industry consolidation (Augustine 1997). This involved the Department of Defense basically endorsing less competition as firms merged. Between 1989 and 1992 the annual value of defense mergers never exceeded \$3B; however, by 1996 the value of defense industry mergers exceeded \$24B (Diamond 1997).

Ironically, just a few years later, the emphasis has now changed back toward increasing competition. For example, in 1997, Secretary of Defense William Cohen initiated several

Defense Reform Initiatives that involved greater emphasis on competition between public and private organizations for support tasks (Evers 1997). Additionally, Undersecretary of Defense of Acquisition Jacques Gansler has recently called for expanded competition in the defense industry and a change in the policy of encouraging defense mergers (Cole and Squeo, 1999).

Recent Acquisition Reform

Recent reform efforts seem to follow a two-pronged strategy of either focusing on saving money that could be used in modernizing existing weapon systems, or consolidating defense industry firms in the face of declining defense budgets. One program consistently highlighted as a success story is the Joint Direct Attack Munition (JDAM). The unit cost of JDAM fell from approximately \$40,000 to \$14,000 by cutting specifications and data requirements (Arana-Barradas 1996). Drawing conclusions from reported acquisition success stories involves two concerns. First, success stories may exhibit reporting bias, since people may be more likely to discuss success than failure. A recent review of military records found small commodity purchases still exhibit excessive prices with a fifteen-cent O-ring gasket being purchased by the Pentagon for \$30 (Margasak 2000). Second, the number of successes may not be large enough to be statistically significant.

Since the end of the Cold War, the United States defense procurement budget has declined by over 60 percent leading to a consolidation in defense firms that was encouraged by the government (Augustine 1997). Boeing, Lockheed Martin, and Raytheon have emerged as the largest DoD suppliers following the defense industry consolidation of the 1990s. Lockheed Martin and Raytheon, the two companies out of the big three defense suppliers with fewer commercial sales, continue to experience financial woes (Squeo 2000a). Even though firms have consolidated, every one of the eight military aircraft lines and five military helicopter lines that was open at the end of the Cold War is still producing aircraft (Sapolsky and Gholz, 1999). This means the mergers in the defense industry have not led to a consolidation of capacity that increases corporate efficiency. One Pentagon solution being considered to keep defense firms solvent is splitting the work to build the Joint Strike Fighter with an estimated value of \$300 billion of the next 20 years between the contracting teams led by Boeing and Lockheed Martin (Squeo 2000b). If the Joint Strike Fighter program is awarded to both contractor teams on a 60/40 split as is now being discussed, the contractors are no longer competing for 100 percent of the contract, but only for 20 percent.

The increased focus on cost by the DoD, a buyer with monopsony power, is leading firms to compete on price (Green et al, 1991). Firms lose higher-order competitive advantage when they resort to competing on price (Porter 1990, 556). One implication of this is firms that are focusing on price are less likely to spend resources on innovation. Nelson (1995) discusses decreased DoD and corporate funding of basic research.

DISCUSSION

Several observations can be made from the review of acquisition practices over the decades since World War II. First, the accumulation of changes itself may be a contributing problem. Drezner et al (1993, 32) concluded cost growth increases on individual programs as a program matures due to the accumulation of changes. This same relationship could apply to the acquisition system as a whole. After five decades of acquisition reform, Secretary of Defense William Perry made the following observation; "The problem is that the DOD's acquisition system is a complex web of laws, regulations, and policies, adopted for laudable reasons over many years" (Perry 1994). Even though the goal of acquisition has often been to streamline, in the 1990's the DoD procurement force still must follow over 30,000 pages of regulations issued from 79 different offices (Gansler 1996). The trend for longer program length has been blamed in part on an increase in acquisition regulations (Drezner and Smith, 1990). Each effort at reform has only added to the regulatory burden of acquisition, yet left the acquisition framework established by the Procurement Act of 1947 largely unchanged.

However, acquisition reform has oscillated between extremes and continued to experience problems. For example, comparisons of programs during the 1950's, of 1960's, 1970's and 1980's show acquisition programs in each decade experienced cost, schedule, and performance difficulties (Perry 1975, and Drezner et al, 1993). This occurred even with multiple reform efforts during this time that were intended to address these issues and often employed opposite means to achieve that aim. The expectation was that implementation of reform initiatives over the years would improve cost performance; however, there is evidence of higher cost overruns after the Packard Commission (Christensen, Searle and Vickery, 1999). One problem is that the reforms often applied "cookie-cutter" solutions to complex acquisition programs procuring diverse weapons systems with different challenges.

This leads to the second observation that the sporadic nature of acquisition reform complicates the task of the cost analyst by adding another degree of uncertainty into the estimating process: a changing regulatory framework. The standard tools of analysis—fitting cost estimating relationships (CERs), using regression analysis, and looking back at analogous systems—share the implicit assumption that the future will resemble the past. Since acquisition reform efforts are designed to make the future different, the usefulness of tools like regression analysis may become problematic.

Specifically, Christensen, Searle, and Vickery (1999) examined 269 contracts over an 8-year period following the Packard Commission and determined that cost performance worsened when compared to the pre-reform period. The average contract cost overrun had gone up by a statistically significant amount—9.5% after Packard versus 5.6% before. Thus, any cost analyst using historical data from before the Packard Commission to fit regression lines to predict program costs following the reforms, was likely to experience systematic downward estimation bias. Moreover, the analyst likely would not have even been aware of the bias.

Even if acquisition reform resulted in a mean-preserving spread (same mean with larger variance) for the cost estimate, the impact is likely to complicate the process of budgeting for programs and assessing contractor and government performance. The mean-preserving spread increases the probability of a realized cost under-run and of a cost over-run. A cost under-run might result in using these "excess" funds to gold-plate the weapons with additional "bells and whistles." Perhaps even more pernicious would be cost over-runs resulting from the greater estimating uncertainty induced by the acquisition reform. What is perceived and criticized as an over-run may be nothing more than a reasonable cost realization given a new and changing acquisition environment. Of course, it may involve a cost over-run requiring management attention. The point is that the cost analyst may not be able to tell.

A third observation is that many acquisition reform initiatives were in reaction to specific events or primarily associated with certain individuals. Some examples of reform due to specific events include:

- In 1950, the reinterpretation of the 1933 Buy America Act to allow licensed production and purchase of F-86 aircraft from Canada (Kroger 1950).
- In 1957, the Advanced Research Projects Agency (ARPA) was created within the DoD to concentrate attention on research and development following the Soviet launch of Sputnik (Putnam 1972).
- In 1975, Congress passed legislation requiring notification and approval by Congress for foreign military sales (FMS) sales over \$25M in reaction to the sale of F-14 aircraft to the Shah of Iran—previously, Congress was not involved in the approval of FMS sales (Brzoska and Ohlson, 1987).
- Cost as an Independent Variable (CAIV) was implemented as smaller Post-Cold War defense budgets made weapon system cost the most important concern (Brink 1997).

Implementing reforms based on events implies that acquisition reform initiatives often treat symptoms instead of identifying the source of problems. Drezner and Smith (1990) suggested that policymakers be suspicious of narrowly focused acquisition policy changes. Critics of Deputy Secretary of Defense Frank Carlucci's reform claim it jumped directly to recommendations and did not include any analysis or discussion tying problems to proposed solutions (Gates and Vernon, 1987). This leads to the second part of the observation that many initiatives have been associated with individuals who advocate for acquisition reform.

Secretary of Defense Robert McNamara began this trend in the 1960's with later reforms being associated with other individuals including Packard, Fitzhugh, Carlucci, Grace, Perry, and Cohen. Initiatives identified with top management can meet with resistance, because of decreased understanding and commitment from other members of an organization (Woolridge and Floyd, 1990). For example, there was resistance not to the ideas of Secretary Robert McNamara, but to the zealous implementation and over-reliance

on quantitative measures (Gates and Vernon, 1987). Implementing reforms in reaction to individuals implies that acquisition reform initiatives may not always have a well thought out and developed strategy, and may have a short effective life.

A final observation is to remember President Eisenhower's warning about the defense-industrial base. Porter (1990, 556) identifies merger and acquisition activity as a potential symptom of an industry's decline, because mergers can lead to decreased rivalry. Additionally, government procurement can work against national competitive advantage if it becomes a guaranteed market (Porter 1990, 644). The post-Cold War focus of Congress, in regard to military budget decisions, has been on retaining jobs (Sapolsky and Gholz, 1999). This has forestalled a consolidation of production facilities within remaining firms, and led companies to potentially focus on price at the expense of innovation.

CONCLUSION

"Carrying out a new plan and acting according to a customary one are things as different as making a road and walking along it."

Joseph A. Schumpeter (1934)

We must question whether the acquisition framework adopted to fight WWII and the Cold War remains viable in the current environment. Studying acquisition reform each decade since World War II, the only constants appear to be change in environmental dynamics, and a recurring fundamental reliance on a foundation built in the post World War II era. Many reform initiatives were either in response to single events, identified with single individuals or heavily influenced by some organization context. They also appear to over-rely upon relatively easily quantifiable performance metrics. Finally, many reform initiatives treat acquisition separately and do not address earlier steps in the national security development process. This might have misdirected well-intended reform initiatives.

Most past acquisition reform initiatives treat symptoms instead of identifying the source of problems. Since the acquisition process has measurable, often visible, and easily quantifiable outputs involving cost overruns, program delays, and other problems, it has often been the focus of reform efforts. Earlier stages of national security strategy development have not received the same scrutiny as acquisition practices (Winnfield 1988). Shortcomings in prior areas of the national security development process can result in a larger burden for acquiring weapon systems, and may be the source of unresolved problems. For example, a substantial amount of the cause of cost growth is beyond the control of the DoD in part due to inadequate program funding levels from Congress (Dews et al, 1979).

In summary, looking at the successes, failures and methods of past acquisition reforms through the lens of past practice leads to the conclusion that long-term impacts of acquisition reform efforts must be viewed skeptically. This is particularly true when viewed from a perspective that acquisition practices, though modified, can be traced to a foundation that

was established by the Procurement Act of 1947. But in the last decade the defense world has changed dramatically—the Soviet threat collapsed and the firms that represent the defense-industrial base have consolidated. Past systems and practices are the building blocks of current and future acquisition management practices. Cost analysts must adapt to new realities, if they desire to accurately estimate the cost of weapon systems. While permanent solutions to our weapon system procurement dilemma will remain elusive, shedding light on future implications, not just focusing on the present or past can enhance the long-term success of acquisition reform initiatives.

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