Cost and Competition in U.S. Defense Acquisition

The meaning of “should cost,” “will cost” and “must cost”

Eric M. Lofgren, Technomics Inc. – June 2018  
International Cost Estimating and Analysis Association (ICEAA)

“It is those who argue that the Government has been paying too much for its weapon systems for too long that argue Will Cost estimates are of little value. The counter argument is that hard resource allocation decisions must be based on the realities of what the Government will have to pay, not on what it would like to pay—not on what the Government, as one party in a two-party contract, believes it should pay.”

Army SAFEGUARD System Office
June, 1972

The price of a good or service is a measure of value. While prices in a market economy are determined by competitive forces of supply and demand, a very different process of price formulation takes place in the United States defense acquisition system. The basis for pricing major defense systems is the marginal cost of production, or the dollar outlays consumed when producing an incremental unit of output. For systems acquisition, two prominent methodologies for marginal costing include “should cost” and “will cost” analyses. This paper will first explore the history of “should cost” and “will cost” in the Department of Defense. Institutional limitations of the analyses will be discussed, leading to the rise of a “must cost” class of cost estimates. The costing methodologies will then be placed in a theoretical context, first with respect to the meaning of competition, and second with respect to the nature of cost. It will be argued that notions of perfect competition and marginal cost, inherent to neoclassical economics, only provide a framework for understanding prices under an assumption of static technology where markets include numerous buyers and sellers. However, central to defense acquisition is the problem of generating technological progress in a non-market environment dominated by a handful of sellers and only one buyer. This paper provides an alternative framework for understanding the role of cost analysis in defense acquisition and suggests that the budget is the most important consideration toward meaningful reform.
“Should Cost” and “Will Cost”

The F-111 aircraft program faced a crisis in 1967. As the joint-service multirole fighter looked to enter production, severe cost growth threatened the F-111’s viability. Pratt & Whitney’s TF30 engine was one problem area, and the Navy brought in a private consulting firm to evaluate the contractor’s operations. The recommendations for optimizing production, as Senator William Proxmire boasted, “resulted in a $100 million price reduction on the TF30 engine contract with Pratt & Whitney” (Hearings, 1969a, p. 164).

And “should cost” analysis was born. Advocates of the approach—drawing heavily from existing best practices in industry and the Department of Defense (DoD)—intended to alleviate fear of a cost disease problem that may result from “will cost” analyses of historical data, often associated with parametric cost estimates. “Will cost” analysis attempts to predict the effort involved in the acquisition of military systems using experience as the most realistic basis for future outcomes. However, “will cost” takes as sacrosanct existing cost figures and may perpetuate gross inefficiencies or neglect new opportunities. Earnest A. Fitzgerald—an analyst ousted from the Air Force for blowing the whistle on cost growth—wrote of “will cost” in 1970 that “This approach builds in, and indeed amplifies, mistakes and inefficiencies of the past in establishing prices for new procurements.”

Persistent cost growth over “will cost” estimates not only signal poor performance, but in fact indicates a race to the bottom.¹ To illustrate, suppose the just and reasonable price for a military system on a cost reimbursable contract could be known to be $10 million. If the contractor produced the system for $12 million, then the DoD has lost $2 million worth of buying power. If the price of the next procurement—whether a new system or a follow-on of the same—is negotiated on the basis on a “will cost” estimate using experience, or $12 million, the starting expectation is for the DoD to again lose $2 million worth of buying power. On the first effort, cost grew from $10 to $12 million, or 20%. If the contractor again came back with 20% cost growth on the second effort, from $12 to $14.4 million, the DoD has only seen cost growth of $2.4 million but has lost $4.4 million worth of buying power; the remaining $2 million of lost buying power was built in from the “will cost” estimate. Over the two procurements, the DoD has lost $6.4 million of cumulative buying power. If there was a third effort and the contractor again experienced 20% cost growth, the incremental loss of buying power will be $7.28 million, an amount greater than the cumulative losses from the first two efforts. The loss of buying power grows exponentially.

In a procurement scheme using “will cost” estimates as the basis of contract negotiations, a constant level of cost growth signals performance deterioration at accelerating rates. Some worried whether large cost growth on the F-111 would bias future “will cost” estimates upward.

¹ Cost growth figures reported in the Selected Acquisition Report (SAR) to Congress are based on program budgets and not contract costs; weapon systems tend to be budgeted to “will cost” estimates. Claims that cost growth has come down as reported in the SAR does not mean acquisition is performing better. It continually performs worse.
As Earnest Fitzgerald later testified to Congress, “… cost estimates for the new generation of fighter aircraft, the F-14 and F-15, are heavily influenced by cost experience on the F-111, which is highly suspect to say the least” (Hearings, 1969b, p. 598). To Fitzgerald, meeting such “will cost” estimates should receive no applause.

The “should cost” approach sought to challenge historical data for inefficiencies using a mix of methods from industrial engineering and cost auditing. The Army “‘Should Cost’ Guide” stated that the difference with “will cost” is “the depth of the analysis and the extent to which the Government challenges inefficiencies in the contractor’s operations” (U.S. Army, 1985, p. 21). “Should cost” requires teams of consultants to reside in the contractor’s plants for weeks or months at a time. Ten points generally addressed in a “should cost” study include: 1) plant layout; 2) labor standards; 3) material control; 4) machine loading and utilization; 5) production scheduling; 6) make-or-buy practices; 7) subcontracting procedures; 8) quality control procedures; 9) indirect cost controls and allocations; and 10) accounting and cost estimating procedures (Storalow, 1971).

Despite its promises, the “should cost” analysis performed by the Navy did not save its F-111B variant. The Navy dropped out of the program for many reasons unsolved by the “should cost” study, leaving the Air Force alone in its procurement of the F-111. Though the Navy had its reservations about “should cost,” elements in the DoD and Congress were enthusiastic about further applications. Congress directed the General Accounting Office (GAO) to investigate “should cost” analysis in 1969. Reports released by the GAO over the next several years were generally favorable to its use in contract negotiations.

Concurrent to early developments in “should cost” were equally strong forces in favor of “will cost” analysis. On July 31, 1969, Deputy Secretary of Defense David Packard issued a widely quoted memo finding the “largest single cause” of cost growth is “overoptimism in cost estimates” (AFM, 1970, p. 35). Bringing the matter home was the Navy’s F-14, whose negotiations proceeded based on cost figures well under the independent government cost estimate derived using “will cost” analysis. Within two years, F-14 costs grew nearly four-fold to match almost exactly the “will cost” estimate. The implications were clear. Had decision makers believed the “will cost” estimate, they would have made extensive tradeoffs or nixed the program all together, perhaps in favor of the lightweight fighter concept starting to come around (Stevenson, 1993). Packard immediately wrote a memo in favor of “will cost” estimates in December 1971, and the next year the Cost Analysis Improvement Group (CAIG) was formed to take charge of producing realistic cost estimates to better inform decision making (Srull, 1998).

The general understanding of the uses of “should cost” and “will cost” are to price contracts aggressively using “should cost” to incentivize performance, and to budget the program conservatively using “will cost” estimates. The conservative budget serves two major purposes. First, it provides accessible funding reserves in case management cannot beat cost targets based on experience. Second, it does not distort major program decisions or tradeoffs by using potentially biased cost figures. An Army study found that “Will Cost estimates result from the
view that, from an overall resource allocations standpoint, the best estimate for any given weapons system program is the one requiring least modification” (U.S. Army, 1972, p. 44). Viewed from a different perspective, Earnest Fitzgerald wrote that “While the parametric, or ‘will cost,’ approach to estimating has some application in projecting funding requirements, the ‘should cost’ approach is infinitely better in procurement if one is interested in saving money” (Fitzgerald, 1970).

**Influence of Uncertainty**

The “should cost” approach taken with Pratt & Whitney on the TF30 engine could only do so much. Many of the savings were theoretical rather than actual, a hard lesson learned in private industry more than 50 years before when it was discovered that marginal costing of direct inputs often led to “perilously” low pricing (Edwards and Walker, 2009, p. 205). Perhaps more importantly, previous decisions in research and development had a major impact on the producibility of the TF30 engine, and the F-111B aircraft system more generally. The limitation of “should cost” was quickly realized by its fathers in the Navy, which conducted only three “should cost” studies between 1973 and 1979 while the Army performed 89 such studies and the Air Force 37. Congressmen wished to understand why such a promising tool as “should cost” was being neglected by the Navy. Frank P. Sanders, Assistant Secretary of the Navy for Installations and Logistics, testified on the subject in December 1969:

“The major “should cost” philosophy is basically that DOD should not endorse contract inefficiency by paying excess costs. This philosophy is fully stated in the ASPR [Armed Services Procurement Regulation], in our pricing policy and practice. In part, at least, it is being continually implemented. The big question is how to fully implement it in a practical manner.

“As [Navy Director of Procurement Control and Clearance] Mr. Rule has discussed... and I must agree with him, that consideration should be confined to procurement areas of sole source. He and I are in agreement that it is impossible to realistically apply the technique used in Pratt & Whitney ‘should cost’ approach to research and development” (Hearings, 1969a, p. 164).

Sanders pointed out that the “should cost” approach was only useable in high rate manufacturing. Navy leadership believed that existing regulations already required such “should cost” duties as a matter of course. However, they did not see “should cost” as practicable for evaluating research and development activities. How could a third-party be expected to evaluate the “production” process of new ideas and new technologies which are nuanced and specialized? Disagreements cannot be resolved by reference to a source of demonstrated knowledge, leading to stalemated arguments. For example, one Army “should cost” analysis reached an impasse after 44 failed negotiation sessions (GAO, 1972, p. 13).

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2 Apparently, the consulting firm (Performance Technology Corporation) which performed the first “should cost” review of Pratt & Whitney was “blackballed” by the Pentagon.
The 1969 definition of “should cost” was “to determine the amount that a product ought to cost, given attainable efficiency and economy of operation.” How much ought it to cost to create technologies that are still speculative? To hint at the difficulties using a simple product, it took seven years of industry studies to establish the standard cost of a 2” x 4” of lumber. Robert Anthony, accounting scholar and former Assistant Secretary of Defense (Comptroller), concluded the idea of a product’s “cost” to be an abstract concept with “no generally accepted meaning” (1970). A “should cost” coordinating committee was formed and still, by 1975, “The committee had not yet resolved the basic question of what should-cost is” (NMARC, 1975, pp. VI-3). Eventually, its inapplicability to R&D was accepted. Richard Haight from the Naval Postgraduate School described the applicability of “should cost” as a function of technological maturity; the more mature the technology, the more applicable the techniques of “should cost” (1974, p. 15). “Should cost,” as entered in the Federal Acquisition Regulation, was of the audit and engineering sort only intended for programs entering full rate production (FAR 15.407-4 and DFAR 215.407-4).

In some cases, “should cost” has been identified with cost estimates based on engineering grass-roots, or bottom-up, methods where each functional process is scrutinized for efficiencies. In other words, not just describing the production process but innovating it. On the other hand, “will cost” has been identified with parametric, or top-down, cost estimating using historical relationships between cost, technical or performance parameters, and quantities. Already on February 6, 1970, the Deputy Secretary of Defense (Resource Analysis) Donald Rice issued a memo on the suitability of each method based on the uncertainty inherent in the acquisition life cycle. Rice concluded:

“The parametric approach is particularly suited to making estimates based on limited physical and performance information… At later stages of the acquisition process, detailed contractor proposals are prepared. Sufficient data then becomes available to allow the use of industrial engineering cost estimating procedures. However, continued use of parametric or partially parametric methods should serve as a check on the engineering cost estimate… It is important to note that such parametric estimates are not recommended for program control purposes, but rather as a means of providing service and OSD management with the most probable resource impact of alternative programming decisions” (1970).

In 2011, Undersecretary for Acquisition, Technology, and Logistics (AT&L) Ashton Carter reintroduced “should cost” in his Better Buying Power (BBP) initiatives. He wrote that “BBP ‘should cost’ management is not your father’s ‘should cost’ review… A BBP ‘should cost’ management approach should be used throughout the program life cycle. It is particularly focused on up-front planning and exploring engineering trades to ensure successful outcomes at every milestone” (Carter & Mueller, 2011). The BBP emphasis on “should cost” was for the entire lifecycle, presumably starting with advanced technology development at Milestone A, and focused on the cost-effectiveness of alternative choices. It is difficult to differentiate this BBP version of “should cost” from the ambitious systems analysis approach followed during the McNamara years. Carter attempted to clarify:
“… some understandable confusion exists as to how to implement both ‘should-cost’ and ‘affordability as a requirement,’ particularly early in a program’s life cycle… The emphasis prior to Milestone B [Full-Scale Development] should be on defining and achieving affordability targets. Past this point, the emphasis shifts to defining and achieving should-cost estimates” (Carter, 2011).

In other words, during advanced development, decision makers are to consider affordability, such as production unit cost targets (e.g., cost as an independent variable and design-to-cost) as well as operating and support costs (e.g., lifecycle costing). Cost targeting is primarily done by trading off requirements based on the relationship between technical features and costs. At Milestone B, when an updated “will cost” estimate—representing most likely funding needs—is generated based on affordability considerations, Carter recommends “should cost” techniques be employed to beat the “will cost” estimate. But as discovered many times over, fundamental uncertainties remain at Milestone B; the final product isn’t often discovered until it enters production and sometimes not until several years into the production run (Drake, 1968).

Economic Influences

Not much has been said recently about how the different phases of the acquisition lifecycle, and the ability of competitive markets to fulfill those needs at each phase, affects our definitions of “should” and “will” cost. Gilbert Fitzhugh, chairman of a President’s Blue Ribbon Panel, very much saw both analyses as complementary if not the same thing. In 1971 he told Congress that “It seems to me a should cost and a parametric cost are in the same family… By commonsense, what should this cost? What did the last rifle cost? What are the components?” (Hearings, 1971). Equally important questions include: How new or customized is the rifle? How many suppliers build the components and the final product? What ought the Government pay, and how much should it pay to find out?

Clearly, in a perfectly competitive commodity market with numerous buyers and sellers who all have complete information, the concepts of “will cost” and “should cost” fade away. The Government should pay the market price; it will be a “price taker.” Competitive forces among market participants generates efficiency in supplier production and pricing. Just as clear is the fact that the acquisition of defense systems does not reflect the idealized neoclassical market.4

Perhaps the most insightful work on the matter came from the Army SAFEGUARD system office in a June 1972 study entitled “Should Cost/Will Cost/Must Cost – A Theory on the Cause

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3 “However, when it comes to cost-performance trade-offs, the calculus is not so straightforward. In 1916, Frederick Lanchester (1916) theorized that the power of a military force is proportional to the square of the number of its units. In theory, then, a force of 15 pieces of artillery will have a nine-fold advantage (in terms of relative effectiveness) over a force consisting of five pieces. Even within the context of modern warfare, technical superiority cannot compensate for an insufficient quantity of weapon systems. Or, as Vladimir Lenin is reported to have said, ‘quantity has a quality all of its own’ (Dunnigan, 2003)” (Gansler and Lucyshyn, 2013)

4 Some have stated the matter more strongly. For example, Harvard researchers Martin Peck and Frederic Scherer—while acknowledging the “multibuyer” aspect of defense acquisition prevalent at the time of their studies—concluded in 1962 that a market for weapons acquisition can never exist.
of Cost Growth.” It found that “should cost” analysis was rationalized by a lack of competition. “As a philosophy,” the study found, “Should Cost holds that the impetus of price competition to produce efficient practices found in the commercial marketplace cannot be relied upon to produce similar practices in the defense industry.” Despite the lack of competition presumed by “should cost” advocates, there appeared to be “some confusion over whether competition exists or does not exist” in the defense industry. The Army study explained how military insiders have described an intensely competitive environment while outside observers held the contrary. The Army SAFEGUARD office concluded that extreme competition does exist, but not in the sense of an idealized market. Instead, there is competition both within the Government for program funding and competition between contractors to win a declining number of contracts, resulting in a “must cost” figure. The study found that “The amount to get the contract approved becomes what the program must cost. Must Cost, as a class of cost estimates, is strongly influenced by the realities of available or estimated to be available resources.” To have a chance of winning the work, a contractor is “constrained to play the Must Cost game” because “Increasing his proposal cost as a result of acting on any Will Cost estimate could cause him to be non-competitive, a rather strong disincentive” (U.S. Army, 1972).

For example, industry “price to win” analyses attempt to develop a competitive price based on estimates of what other suppliers will bid, as well as estimates of what the customer is willing to accept. Lawrence E. Casper recommends the customer’s budget as the starting point for “price to win” analyses, which is made publicly available in the U.S. (2015, p. 13-14). Faced with institutional constraints, it becomes a difficult task for Government officials to pass over the lowest priced proposal for the most reasonably priced.

Because of downward pressures unabated, “should cost” and “must cost” estimates tend toward similar figures. Program advocates in the Government require certain cost figures to make the program appear not only more cost-effective and therefore justifiable, but to force its fit within the upcoming budget submission. Understanding such constraints, contractors cut cost estimates as they move up the executive levels to stay competitive with the expectation that either: 1) the contract price will be adjusted upward through change orders and other means; or 2) follow-on contracts will be over-priced to recover losses on the original “buy-in” effort (Orkand Corp., 1973, p. 27). Similarly, when a “should cost” analysis results in a figure below the contractor’s expectations, the contractor doesn’t reject the deal because “the taint of a non-cooperative attitude is tantamount to being stricken from the bidder’s list” (U.S. Army, 1972). The contractor is obliged to go along with “should cost” estimates even if “disagreements still exist.” His perceived

5 An example demonstrating the importance of judgement and reputation in systems acquisition comes from the F-18 program, when political factors created technically challenging requirements for its radar. Instead of selecting the lowest priced bid (such as required by “Lowest Price Technically Acceptable” mandates for source selection), the prime contractor, McDonnell Douglas, selected the most expensive bid because it was deemed the only one that reflected the challenges involved. The F-18 radar met its constrained size requirements and provided detection for both air and ground targets (Orr, 1990).
underpricing of specific contracts and recoupment through other means is “just part of being in business with the Government” (Williams, p. 35).

The process whereby competitive pressures in the Government and industry drive cost estimates below the “will cost” figure creates an “uncoupling” of military requirements and the costs of delivering on those requirements. The program proceeds using planned costs that do not reflect the requirements involved. The probable outcome is de-scoping requirements to fit within the cost constraint, or, what is more likely, increasing costs to meet the original requirements. Yet recognition of this reality occurs slowly and only after many sunk resources. “Living with a Must Cost number,” the Army study found, “is not unlike living on the side of a volcano. One may live in peace and tranquility for years without getting burned” (U.S., Army, 1972).

The most important market condition which incentivizes “must cost” estimates and cost growth is monopsony. Monopsony is the term for a commodity market that includes numerous sellers and a single buyer. It is generally assumed that the single buyer, using its dominant position, can force prices down to marginal cost. “The concept of monopsony,” Herbert Spiro wrote, “assumes the inability of suppliers to one customer to find alternate buyers of their products.” Indeed, defense contractors are often unable to transfer specialized technical, marketing, and management resources—all of which are regulated by the Government—over to the commercial sector. “In effect,” Spiro continued, a monopsonist “can command, at least in the short run, prices which are below even the marginal cost of the suppliers” (1972, p. 16). However, the situation introduces “serious questions with regard to the long-run strength of the industry” (Orkand Corp., 1973, p. 15). One industry executive remarked in 1970 that “there isn’t a company in this country today whose board isn’t sitting up nights trying to think up ways to get out of the defense business” (AFM, 1970). By the 1980s, investors were rewarding companies for leaving the defense sector as the industry rapidly consolidated despite growing military budgets (Watts, 2008, p. 25-26). All this happened before the Government encouraged industry consolidation in the post-Cold War 1990s, leaving only two or three prime contractors in each commodity class.6

Government powers as a monopsonist in defense markets are exerted through conditions and regulations placed on contract vehicles. For example, the Government will not reimburse “unallowable” costs—such as advertising and some forms of interest—and puts caps on other costs such as pre-contract, travel, and training costs. Such costs are part of normal business operations in the commercial sector. Special reporting requirements also contribute to a major share of defense costs, one study found them comprising 10% of total procurement costs. Perhaps most onerously, a long list of regulations restricts contractor decision making. Murray Widenbaum found that the Government has decision power in: 1) make-or-buy practices; 2) selection of subcontractors; 3) purchases made foreign and domestic; 4) internal financial reporting systems; 5) industrial engineering and planning systems; and 6) minimum and average wage rates. Costs

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6 Norman Augustine recounted a 1993 sit down with then Secretary of Defense Les Aspin and his Deputy, William Perry, who told a room full of company presidents that they would stand by to see half of them go out of business. Augustine famously called it the “Last Supper” (Augustine, 1997).
are expected to increase from such interventions “Unless one is willing to adopt the view that the government buyer can manage a private organization better than can the company’s own management” (Orkand Corp., 1973, p. 25-30). Such a view, however, is adopted in “should cost” analysis, which presumes that “Government analysts are better trained, more knowledgeable, more objective and/or more dedicated to achieving more for the defense dollar than are their counterparts in the defense industry” (U.S. Army, 1972, p. 42).

In many ways, the long list of rules and regulations mandated in defense contracts is a reaction to the Government’s disadvantage in contract negotiations. RAND analyst Frederick T. Moore found that the Government could not press its monopsony position in defense markets because it “lacks the skills and resources to make the necessary technical and cost evaluations of contractors’ proposals.” It must rely instead on “information supplied by the firm” (1962, p. 54). Special disadvantages to the Government in contract negotiations include asymmetry of rewards and disparity of status between bargainers. And when these matters do not take precedent, to press upon industry the Government’s monopsony position “is to invite the charge of an arbitrary exercise of power” (Williamson, 1967, p. 231). The Government uses its monopsony power in specific and reactionary ways, not to force the lowest possible cost, but to offset the information and incentive disadvantages inherent to its position.

**Competition**

Whether government officials have an advantage or disadvantage in contract negotiations depends on the context. “Should cost” and “will cost” indicate the conflicting bargaining positions of a monopsonist Government in defense markets. A “should cost” analysis reflects the advantages of Government to negotiate prices downward but is motivated by a belief that industry has grown fat from its strong negotiating position. In a similar vein, a “will cost” analysis reflects the advantage of Government to collect and synthesize market information but is motivated by a belief that it cannot properly evaluate specific contract proposals or change orders in a vacuum. At the risk of over-generalizing, the Government may have leverage in pricing contracts for new programs—creating a “must cost” figure—while industry has leverage in pricing follow-on production and maintenance contracts for established programs. In the former case, the contractor cannot walk away from what might be a once in a generation program within a commodity class. In the latter case, the Government cannot walk away from a significant investment which disrupts bureaucratic plans and creates military capability gaps. “The root cause of cost growth on major weapon systems,” the 1972 Army study concluded, “is monopsony. Cost Growth is the backlash of monopsonistic practices.” It continued to say that “Monopsony is a collective phenomena. It is an aggregate condition producing an aggregate result. No one is to blame; everyone is to blame” (U.S. Army, 1972, p. 59-60).

Monopsony is not an inevitability of military procurement. The rivalrous multi-buyer nature of defense was well established up until the McNamara years. Rivalry within the Services

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7 The examples of monopsony power stand more than forty years later. A significant disburden to the defense industry was the dissolution of the Renegotiations Board which recouped “excess” profits, a subjective and inconsistent term.
(such as missile development in the Navy’s Bureau of Aeronautics and Bureau of Ordnance) and between the Services (such as aircraft development) was rampant in the 1940s and 1950s. Though rapid advances were achieved, the negative perception of duplication and parochialism led to successive rounds of organizational and budgeting reforms that centralized the decision-making process (Converse III, 2012; Poole, 2013). Packard’s decentralizing efforts starting in 1969 did little to stem the tide. Admiral Hyman Rickover complained two years later that “A program manager today would require at least 48 hours a day of his own time just to satisfy the requests for detailed information from the Service and OSD bureaucracies, the Congress, the General Accounting Office, and various other parties who have the legal right” (Hearings, 1971, p. 308). The Army and Navy released reviews of the acquisition system that strongly supported Rickover’s claims of excessive layering in decision making (AMARC, 1974; NMARC, 1975). Even though Packard intended to cut the layering again in 1985 using his influence with the Goldwater-Nichols reform, in 2015 the DoD identified more than 50 offices involved in each major program decision (OUSD AT&L, p. 53).

The result of layered decision making is a consensus, and a consensus breeds monopsony. Indeed, a consensus on long-term plans and near-term budgets has been exactly the goal of defense acquisition reform efforts. The most important factor in consensus building is the budget, which in defense acquisition controls the goals and programs to be accomplished in addition to the means of achieving those ends through organization and object-class. When budgets are categorized in terms of programs with expenditure profiles extending many years, plans become locked-in and re-direction becomes difficult. Once a consensus is built on the requirements involved and a program is authorized to start spending significant sums, the program manager does not have the right to unilaterally change requirements or funding, and therefore must brief—or market—changes to dozens of offices throughout the administrative structure. The logic of the process is that deviations require re-evaluation of the program’s cost-effectiveness in relation to the total force structure. The layered process is a bulwark against an anarchy of uncoordinated plans, which, due to their interconnections, cannot effectively be decentralized to divisional units. As one observer put it: “Under divided administration, the action open to a particular administrator is dependent upon the action to be taken simultaneously by other administrators. Consequently, coordination of his plans with those of the other administrators must occur before his final decision can be made” (Thirlby, 1981).

The desire to keep program and portfolio plans stable creates a need for assurance in project execution. The Government holds the program manager responsible for attaining an externally derived set of capabilities on-time and on-budget but exerts detailed controls on his behalf by regulating contractor operations. Consensus-building and its corresponding contract regulations has led to a slothful process. Undersecretary of AT&L Ellen Lord spoke of reducing the time between request for proposal and contract award from 2½ years to 12 months, when that figure

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8 Centralizing reforms got underway in WWII (Army Reorganization, 1942), then created the Secretary of Defense (National Security Act, 1947), gave him authority over a unified budget (NSA Amendment, 1949), provided him a large staff (Reorganization Act, 1953), and gave him operating powers (Reorganization Act, 1958) all before Secretary of Defense Robert McNamara’s more thoroughly centralizing reforms in 1961.

9 The GAO similarly found that preparation for Milestone B took an average of 55 briefings to various decision makers.
should be between one and two months (Fischetti, 2018). Speed is the key to success, as Japanese automakers and Silicon Valley tech firms have discovered. But commercial firms do not build product lines larger than themselves. Lockheed Martin—the firm with more defense sales than any other in the world—has a market capitalization of roughly $100 billion in 2018 while a single program under its portfolio has an acquisition cost estimated at nearly $400 billion. All this is to imply that the rivalrous and trial-and-error nature of market processes cannot be afforded in defense acquisition; the inclination in the defense market is to require detailed execution plans before-the-fact and hold participants to promises made several years ago, usually by different individuals.

While a weapon systems program may be larger than the firm, obliging the Government’s involvement, it is also true that the Government is made up of individuals, the best of which cannot integrate under one mind the entire possible set of defense needs and production technologies. Systems complexity generates intricacies beyond any one person’s comprehension. Each person is endowed with, and accumulates, special knowledge which results in conflicting views of technical and military feasibility. For a complex process to operate, numerous interconnected plans must be made simultaneously by constituents with unique and partial sets of knowledge. This creates a degree of contention between the plans, which are coordinated after-the-fact. The rivalry in the 1940s and 1950s that was stamped out of Government acquisition is necessary to generate information that no rival on its own could have possessed in the absence of that rivalry. The current program planning process takes as “givens” basic questions of technical specification and cost. Those “givens,” generated through the consensus-building bureaucracies, are transmitted to industry which “competes” for them in a narrow sense. However, the real utility of competition is in discovering the decision maker’s “givens,” or what the product should look like and how it should be priced. These are decisions of the innovator and not the consumer whose feedback comes in the form of sales. The value of any choice cannot be known until the product is completed, and even then, military environments change. Competition depends on divergent expectations and only provides after-the-fact realization of the relatively more efficient—and not the most efficient—plan.

To summarize, if participants have meaningful specialization, parochial views emerge. It is in special knowledge that divergent expectations arise, and under uncertainty, the only way to discover whose expectations better conforms to reality is to execute the alternatives. Decentralized organizations naturally develop those alternatives and bring them into competition. Failure to deliver a product more desirable than competitors acts as a filter, removing inefficient performers which otherwise could not be identified. Though superficially redundant and inefficient, the competitive process ultimately saves resources because of the filtering process.

“But what is our procedure,” the 1972 Army study asked, if we have an “institution where large numbers of individuals conduct themselves in an individually commendable manner but whose collective actions create problems?” Indeed, rivalry may lead to an unbalanced military force, which the U.S. was heading toward by the end of the 1950s prompting McNamara’s call for

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10 More technically, systems complexity occurs when ensemble behavior cannot be predicted by its components (Taleb, 2018, p. 69).
a “flexible response.” Central planning of military requirements and force structure appears the safe way to operate; planners feel like they know where they are going. Though the Army study clearly pointed to monopsony as a scourge, it did not resolve the problems that may arise from decentralization. However, another interpretation of the 1940s and 1950s era is that defense acquisition followed technology “fads” using implicit coordination. Parallel developments applying different technical or doctrinal concepts migrated from one technology area to another based on the opportunities presented to researchers and managers close to operations. In contrast, the “requirements pull” approach which has dominated since the 1960s often seeks to dictate the path of technology from centralized offices taking user input (Glennan, 1965). A naturally evolving serial approach to parallel development—from one area of opportunity to the next—avoids busting budget caps, which would be the case if parallel projects were pursued in all military technologies at the same time.

The most important aspect of the competitive view is that it establishes multiple buyers with overlapping interests to engage with industry. If the public finds a monopolist defense contractor to be an unacceptable proposition, “should not monopsony,” the 1972 Army study contended, “be viewed with similar concern?” Both sides to an agreement should be able to walk away from the table and say “thanks, but no thanks” without undue harm. A balanced bargaining position in contract negotiations is an end for its own right for the defense acquisition system.

An essential element to the cure for monopsony is an organizational, and not a program, budget, where control is exerted after-the-fact. It fosters relational contracting based on reward and punishment, but only after some knowledge of the consequences is learned. Congress has slowly moved towards an organizational procurement budget. The Special Operations Command has had its own procurement authorities since 2001, and the experience has generated a good deal of praise (Erwin, 2016). The 2017 National Defense Authorization Act provided similar budget and procurement authorities to Cyber Command (Snyder & Sulmeyer, 2017).

A distinguishing factor between a program budget and an organizational budget, as between central planning and market processes, is the timing of coordination. Central planning pre-coordinates all activities by synthesizing information delivered by dispersed units to find the optimal course. The program budget reflects such before-the-fact control with respect to internal DoD administration, as does the contract with respect to external industrial relations. Markets are based on the freedom to choose. Though redundancy and waste are easily spotted, they are a necessary part of technological progress. The analogy for internal administration is to provide the manager with wide latitude to make decisions based on considerations of earned trust. Like entrepreneurs, managers must be aware of an ever-changing environment and must be able to exploit unappreciated opportunities short of building a defense-wide consensus. The corollary is that the assignment of responsibility for failure must be absolute, and further, known to be so by all managers when taking on risk. The program didn’t fail because of one realized risk or another, but because of personal failings of the manager to whom budget was entrusted.

It is probably not at all likely that a market resembling our everyday experience is feasible in defense acquisition, nor would that outcome be necessarily desirable. Many problems are alleviated because defense acquisition floats in a sea of market activity. Competitive prices already
exist, such as for higher order goods in the production chain including oil and steel. This greatly helps Government and industry’s calculations as to economic and non-economic processes. However, when consciously planning major defense projects, defense unique elements must be calculated based on labor standards, the basic planning method of market socialism. In other words, how many hours of labor does it take to generate an outcome? One problem with labor standards is the heterogeneous nature of labor. Individuals have varying levels of skill which makes them non-substitutable, and benchmarked labor rates prevent identification of differentiation among teams. Another problem is that adding more labor does not necessarily increase output. Moreover, historical labor standards are not predictive of new manufacturing technologies.

Unless only the smallest of advances are sought, military systems are necessarily ill-defined. The holistic planning of such programs is inefficient because plans at the later stages must be scrapped based on updated information, or because the project will fail to take advantage of new information gained along the way (Klein, Meckling, & Mesthene, 1958). What is needed is rapid adaptation to changing circumstances in the project, which is embedded in a much larger systems development environment. This is not achieved by adding control or incentive schemes, but by creating an organizational budget where local managers have the right to ramp up, modify, or cancel a project based on updated expectations. The program, then, becomes an historical artifact emerging from multi-faceted operations rather than from a rigid plan for future action. Planning still occurs at the lower levels but is flexible to a degree that bureaucratic consensus making—and monopsony—is not. Programs which test successfully will then enter considerations for production based on current needs of the military force structure rather than the forecasted military environment five or ten or thirty years hence.

It’s All Relative

The discussion has not left the concepts of “should cost” and “will cost” behind. They represent the monopsonist’s tools for determining prices in lieu of those which arise from competitive exchange between buyers and sellers. The opening section of this paper assumed that the “just and reasonable price” of a system could be known to be $10 million independent of the context it was presented under, and from this, a justification for “should cost” and “will cost.” The logic stands on an objective view of value. The view attaches dollar outlays to factor resources, such as labor and materials, which carry those dollars throughout the stages of production and ultimately define the end product’s cost. Production cost, under the “objective view,” explains the value of a good or service, and is the basis for price determination in defense acquisition. “Should cost”

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11 Increasing labor may create the “too many cooks in the kitchen” effect. In R&D, “the really significant advances are made by a very small handful, and that the possibilities of substituting larger numbers of less skilled personnel are extremely limited. The most critical problem, therefore, seems to be the recognition of this scarce talent and its most effective use” (Arrow, 1955).

12 The Navy, for example, presents a thirty year shipbuilding program to Congress which implies operating and maintenance costs extending well past fifty years. The argument does not mean that “moon shot” projects should never be undertaken using a special projects office. Calculated risks must be taken, but should not be the regular course for acquisitions.
and “will cost” analyses attempt to determine the marginal cost of major defense systems and pay the cost with certain criteria for accounting profits.

The competitive approach described above, on the other hand, is based on divergent expectations of market participants. The suppliers see the same factor resources—labor and materials—but they disagree on what choices should be made in their combination, and therefore disagree on the true cost of the factors. If a unit of labor can produce more value in one process relative to another, then the decision maker’s view of its cost depends on the decisions he makes. Lionel Robbins wrote that “The process of valuation is essentially a process of choice, and costs are the negative aspect of this process” (1934). Whether the supplier made good choices resulting from their evaluation of factor prices is determined after-the-fact by the buyers. In the “subjective view,” costs are uniquely determined by each decision maker and only relevant at the time of making the decision.13

Though the “objective view” dominates the business practice of the Department of Defense, the “subjective view” of cost has been accepted in economic theory since the so-called marginal revolution. The cost of producing a good is irrelevant to the buyer. Art is one obvious example. But consider the cathode ray tube TV; once the price of flat-screen TVs came down enough the price of the old style went basically to zero even though the cost of production did not. The price of a good or service is a cost to the buyer and the cost consists of the buyer’s own valuation of foregone alternatives, and though a cost is dated at the time of commitment, values change with technology, tastes, and information (Buchanan, 1969). As G.F. Thirlby explained:

“The act of discovering cost, which really means discovering which of the considered alternatives is to be rejected, inevitably involves valuation… This valuation necessarily involves estimates of happenings in the future about which the decision-maker can never be certain. The decision is based upon ex ante reckonings, or advance calculations, which involve looking into the future, and consequently must, even for this reason, be matters of opinion” (1981).

The “subjective view” was clearly understood by Harvey Sapolsky in his classic book on the Fleet Ballistic Missile (FBM) program (1972). “Calculating the dollar cost of the FBM system,” Sapolsky wrote, “does not reveal its true price. To determine that, the opportunity costs involved in creating the system must be considered. The $10 billion allocated to the Polaris had many alternative uses, all of which had to be sacrificed with the decision to move ahead with the system.” The FBM not only drew away dollars from Navy operations and maintenance as well as other missile developments, it sucked up the best talent from Navy programs and could perhaps be the cause of some failures. Yet the FBM program was worth the opportunity costs because the Navy and the nation placed overwhelming value on developing an invulnerable nuclear platform. Such imperatives of force structure are rarely so clear to defense decision makers.

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13 Don Lavoie framed the matter well: “The depiction of costs in terms of marginal and average cost curves for heuristic purposes led many to presume that costs are objectively knowable, that for a systematic observation of economic phenomena the observer can somehow actually plot costs on graphs as a meteorologist plots cloud patterns” (Lavoie, p. 101-102).
In economics, the “subjective view” of cost is called opportunity cost, a concept widely agreed upon but hardly ever employed. For example, “should cost” and “will cost” analyses only reference objective dollar outlays and do not consider non-monetary aspects of the cost, such as the ends for which labor or material are employed. The objects of cost are treated as commodities whose value does not change under the context it is presented. For repetitive production, the amount of non-monetary aspects related to cost is relatively small (though morale, supply chains, training, and so forth, still matter). Ultimately, however, it is product innovation that advances military capabilities, and the precise relationship between factor resource prices and their contribution to innovation cannot be specified. Objective dollar outlays cannot be simply aggregated into statistical form when considering specific decisions (Hayek, 1945). When all relevant “factor and product values are assumed known,” Jack Wiseman remarked, “there is no doubt about the production decisions to be taken.” The concept of cost, under such assumptions, is fundamentally a problem of scarcity and contains no element of uncertainty (Wiseman, 1981). In “should cost” and “will cost” analyses, judgements about opportunity cost do not arise. They merely apply known industrial or statistical techniques to known cost data in relation to known product specifications.

Both “should cost” and “will cost” rely on costing systems to record the empirical dollars outlays which are analyzed to determine a product’s marginal cost, which in turn is interpreted as the basis of a “fair and reasonable” price. The need for such a process is to admit that the buyer has no foundation upon which to measure a product’s value to national security, and whether it is worth the price offered independent of such information. Certainly the abject failure of systems analysis in the 1950s and 1960s to measure military benefits, from such problems as incommensurables, has led to the “bean counting” nature of cost analysis ever since (Hearings, 1970). Even though dollar outlays can be objectively measured—just as beans can be counted—their assignment to a product’s cost is highly arbitrary, and therefore subjective. Robert Anthony wrote:

“Suppose the president of a widget company says, ‘Last year our cost of manufacturing widgets was $1.80 each.’ The ordinary person may think he has learned a concrete piece of information from this statement.

“Anyone who understands the vagaries of cost accounting knows differently. He knows that ‘cost’ in this context has no generally accepted meaning” (1970).

Costing systems can track the factors used in production for direct, or prime, costs which are relatively large physical items. But there is no generally acceptable method for allocating indirect, or overhead costs, such as the rent, utilities, administration, rates of depreciation, the assignment of R&D or by-products, and so forth. Admiral Hyman Rickover, the “father” of the nuclear Navy and engineering savant, nevertheless had to learn a great deal of accounting to accomplish work in the acquisition system. He testified to Congress that “anyone who tries to tell you they have no trouble determining costs should be required to do some explaining” (Hearings, 1968).

Note that major system contracts report costs by Work Breakdown Structure (WBS), which decomposes the system into a hierarchy of subsystems, components, and so forth. Yet there remains substantial subjectivity over cost assignments to standardized descriptions.
Rickover’s solution, the Cost Accounting Standards, which continues to survive in the Department of Defense, has not resolved fundamental issues of determining an item’s cost. Indeed, the high demand for accountants, auditors, and cost analysts reflects the fact that costs cannot be strictly calculated from the data using explicit rules. These professions work in ambiguity.

Even if accounting records could disclose the costs of past operations unambiguously, Ronald Coase argued that “Business decisions depend on estimates of the future. Accounting records cannot therefore be used as a guide for future action without considering how far the conditions which have existed in the past will continue in the future” (1938). Accounting scholar R.S. Edwards agreed that the data are only useful in so far as a guide to future costs. Edwards believed that the primary purpose of the cost accountant is to tell management the minimum at which new work can be taken on, or stated differently, how costs change with output. But he appreciated the local assumptions that must be made, because “costs which are fixed for a day may be variable in a week” (1937).

Though tracking physical resource costs may explain the long run price under static technical conditions, the most important aspects of the modern economy have nothing to do with repetitive production. Costing problems are compounded when considering new ideas and non-reproducible production. For example, software represents a product whose marginal cost of reproduction is zero. Software companies do not own physical assets in the same way steel manufacturers do; they own intellectual property and a company culture that is embodied in lines of code, reputation, and the potential for great ideas. Much of their value is intangible. For example, in 2006 Microsoft had only $3 billion in plant and equipment assets, a mere one percent of its market value. The price of Microsoft products cannot be explained by costing the activities of related to tangible assets. Investment in intangible assets not amenable to costing methodologies include computerized information (software and databases), innovative property (R&D, patents, copyrights, product designs, trademarks), and economic competences (training, branding, business processes, supply chains, company culture). Intangible investments require real dollar outlays, but their precise contribution to sources of revenue is unclear, and their importance has only increased as innovation has taken preeminence over repetitive production (Haskel and Westlake, 2018). Baruch Lev and Feng Gu found that the value of tangible assets and earnings explained more than 80% of companies’ value when entering the stock market from 1950 to 1959, whereas the figure over the period 2000 to 2013 is just over 20% (2016). Applying the concepts to the DoD, Scott Trail wrote how “A case could be made that cost focused acquisition reform has actually increased costs rather than reduced them… Shifting the focus from cost alone to value will require taking into account the intangibles” (2015).

Ronald Coase already understood intangibles in 1938, writing that “costs and receipts cannot be expressed unambiguously in money terms since courses of action may have advantages and disadvantages which are not monetary in character, because of the existence of uncertainty and also because of differences in the point of time at which payments are made and receipts obtained.” For example, when producing software, as when producing new ideas, the ultimate product and its value to potential buyers is still an imagining of the innovator. Yet he must make cost decisions before the results of those decisions can be known and cannot liquidate the
investment as though it were plant or an intermediate good. Intangible investments tend to be sunk investments irredeemable in their pieces, but through synergies, spillovers, and scalability, the future value of combined investment can be quite substantial (Haskel & Westlake, 2018). The choice to take on a cost only makes sense in relation to the value generated down the line from that cost. When the potential value is as uncertain as the value of alternative courses of action, it cannot be said whether the dollar outlays were worth the cost or not. In “objective view,” the end product’s value is determined by the historical cost of its factor inputs. In the “subjective view,” the factor input prices are derived from evaluations placed on the future value of the final product. The latter view is implicitly observed in startups and tech companies, which often relate labor pay to future value through equity sharing arrangements because opportunity costs cannot be treated as known dollar outlays.

The marginal costing rule followed by “should cost” and “will cost” analyses attempt to approximate the outcome of perfectly competitive markets. Such idealized markets, however, have no such rule in which firms seek to price their output at marginal cost; it is an outcome of interactions between various buyers and sellers. The final check on supplier efficiency is bankruptcy, not the marginal cost-price calculation. Yet in defense acquisition, as in market socialism, pricing outputs at marginal cost is an administrative rule to be followed. The rule presents a problem for determining performance. “If no rule other than the marginal cost rule is used,” Jack Wiseman pointed out, “is there any check on the efficiency of the distribution of resources between uses?” He answered that there may be a check upon the reasonableness of estimates when “the alternatives considered relate to the production of known things by known methods.” This is precisely the usefulness of “should cost” and “will cost” analyses. However, Wiseman (1981) had a different answer under uncertainty and intangible investments:

“The imponderables, and with them the difficulty of a direct check on efficiency, become the greater the more unique or novel are the matters with which decisions are concerned. All decisions about new and major investments of resources seem likely to involve important imponderables of this kind; it appears that those decisions likely to be most important to efficiency will be those upon which no adequate check can be made with the rule as now interpreted… There seems little possibility of a direct check upon whether the marginal-cost rule has been obeyed.”

The only check on efficiency then becomes the comparison of budgeted outlays with realized outlays, assuming away judgments about the value of foregone alternatives. In other words, the only efficiency check on the marginal cost rule is a check on the manager’s ability to forecast, which accounts for the Department’s obsession with program and contract cost growth figures. Such figures can only provide a partial check not only because the initial cost estimate may be biased by institutional factors, as David Packard has found, but because cost growth cannot explain whether that program plan should have been chosen at all. When the plan is that of the central authority, the problems are compounded because the ability to correct errors depends on the ability of the manager to convince the central authority that an error has indeed occurred in relation to the larger plan. Wiseman concluded that “any restriction on the field of choice of managers is… a curb on efficiency” (1981).
In the Department of Defense, the centrally planned program budget restricts the decision making of local managers. If the manager carries out the program plan decided by the consensus building bureaucracy, then he has executed standing orders and has made no decision of consequence. The manager cannot be said to have incurred any costs himself, no matter how many times dollars were converted into goods by purchase or hire (Thirlby, 1981). A program budget chooses before-the-fact matters of cost, schedule, and technical or performance attributes, highly restricting the manager’s ability to consider alternatives. Program funding then gets locked into a narrow range of choices, meaning the opportunity cost of alternative actions is quite low, regardless of the actual dollars paid. Managers see money as cheap. Samuel Huntington famously observed that the manager, “if forced to choose, normally prefers fewer resources and greater freedom to allocate them as he sees fit than more resources less subject to his control” (1969). When control is restricted, the manager has a low opportunity cost of alternative uses of money, and therefore is more likely to expend effort to increase his topline budget at the expense of other managers rather than to seek more efficient contractors and project plans for the money he has available (Mosher, 1954).

**Conclusion**

The foregoing may be criticized for being abstract, but there is not room for practical applications of the cost and competition concepts presented herein. Cost analysts must consider the institutional context of their work and what value they bring to the acquisition process. This paper merely sketches a framework upon which that self-examination should build. The pursuit of marginal costing of defense goods due to misunderstandings about the nature of cost and competition has been precisely that path which has generated a monopsony-oligopoly structure for major defense systems. It focuses on the most efficient allocation of scarce resources and leads to “antisocial practices” such as the demands for “an ‘orderly competition’ which will secure a fair return on capital and the destruction of excess capacity.” Friedrich Hayek wrote that “Enthusiasm for perfect competition in theory and the support of monopoly in practice are indeed surprisingly often found to live together” (1946).

A different view of competition finds that people make decisions which shape the structure of the market, and in turn are shaped by the market decisions of others. It takes an exchange-oriented approach. People face genuine choices, and the consequences to their utility cannot be fully calculated beforehand. In fact, the chooser’s perception of value is “generated in the choosing process, not separately from such process… The potential participants do not know until they enter the process what their own choices will be” (Buchanan, 1982). Put another way, “In actual life the fact that our inadequate knowledge of the available commodities or services is made up for by our experience with the persons or firms supplying them—that competition is in a large measure competition for reputation or good will—is one of the most important facts which enables us to solve our daily problems…. Competition is essentially a process of the formation of opinion: by spreading information (Hayek, 1946). The Department of Defense, in contrast, attempts to spread objective cost information under the expectation that managers will be able to fully consider the alternatives and develop an executable project plan before full-scale development commences.
The essential point is that the opportunity cost of alternative actions is a valuation process that requires experience with production and people in addition to experience with money calculations. The organizationally based acquisition budget is the first and most important step towards better incorporating non-monetary opportunity costs into decision making on major defense systems. In a complex world, analysis supplements judgment, and not the other way around. Leadership must put the development of people first, who can then build the deep experienced required to make winning value judgements in a highly competitive, and innovative, environment. The reader is left to consider the following story from Wilfred J. McNeil, the Pentagon’s top budgeteer for the first six Secretaries of Defense:

“My dad had a country bank in Iowa. When I was ten or twelve years old, I would stand at the front window and look down at the grain elevator and see a kid coming in with a wagon load of grain. He'd look at the weigh ticket and drive on. That kid knew instantly if the bushels ticketed matched up with the inches of wagon box, and he would catch it if it were wrong. He didn't know within ten pounds, but he sure knew within a bushel what he had on board. How many people know the inches to a bushel in a wagon lot? So, if you can get that kind of relationship translated to airplanes and maintenance, painting buildings, heating, or what not in rough rules of thumb you can do an awful lot and do it pretty easy” (1972).

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15 Tech entrepreneur Ben Horowitz said that “We take care of the people, the products and the profits, in that order” (Horowitz, 2013). Similarly, aviator and military strategist Col. John Boyd said that it’s “People, ideas and hardware—in that order!” (Wilcox, 2012).
References:


