Executive Summary

Introduction

This paper proposes a departmental acquisition strategy that will meet the future needs of our forces with highly capable systems at affordable costs and possibly shorter schedules. This strategy entails setting *aggressive*, realistic cost objectives for acquiring defense systems, and managing risks to obtain those objectives. Cost objectives must balance mission needs with projected out-year resources, taking into account existing technology as well as high-confidence maturation of new technologies. This concept has become known as "cost as an independent variable" (CAIV), meaning that, once the system performance and objective cost are decided (on the basis of cost-performance tradeoffs), the acquisition process will make cost more of a constraint, and less of a variable, while nonetheless obtaining the needed military capability of the system.

Conceptual Approach

A key tenet of the CAIV approach is a far stronger *user* role in the process through participation in setting and adjusting program goals throughout the program, particularly in the cost-performance tradeoff process. Working within that context, this paper outlines a process toward achieving the objectives of cost as an independent variable, which include:

- Setting realistic but *aggressive cost objectives* early in each acquisition program
- *Managing risks* to achieve *cost, schedule* and *performance* objectives
- Devising appropriate *metrics* for tracking progress in setting and achieving cost objectives
- *Motivating* government and industry managers to achieve program objectives
- Putting in place *for fielded systems* additional incentives to reduce operating and support costs

Cost-Performance Tradeoffs

Several programs, both today and in the past, have employed CAIV principles. However, until recently, our goal-setting processes have been largely driven by an unrelenting threat and by available technology, not always emphasizing cost-performance tradeoffs in setting program goals. The CAIV approach formalizes the process for cost-performance tradeoff and better connects the user, supporter and developer to facilitate effective tradeoffs, arriving at an affordable balance among performance and schedule. These tradeoffs in fact have the potential to empower the user to make choices that provide the best performance for the money for each system, thereby helping to ensure maximum benefit from all systems across the force within the resources available.

Setting Aggressive Cost Objectives

Aggressive cost objectives means costs objectives that are the DoD-equivalent of sound commercial business practices. These objectives will be set as early as possible (e.g., Milestone I or before for most systems). It is expected that these objectives will be much lower than would be projected for a system using past ways of doing business.

However, investments associated with realizing longer-term savings (e.g., O&S costs) may increase costs in the early phases of a program. These cost objectives should be used with appropriate vehicles, such as RFIs, RFPs, and eventually, program contracts.

Motivation and Incentives For Achieving Cost Objectives

A significant challenge in implementing CAIV is motivating both DoD and industry managers to innovate and accept larger risks in order to achieve breakthroughs in cost and performance, while not penalizing failures that might occur despite best management efforts. A further challenge will be to promote Congressional acceptance of this new way of doing business, even though open identification of risks might be used by those opposed to a program.

The group's proposals fall within the flexibility of current acquisition policies. Those proposals, in the main, recognize existing policies that have proven effective in motivating both government managers and industry. Not surprisingly, longstanding, time-proven approaches such as competition, profit motivation, and integrated product teams, are some of the mechanisms. Setting aggressive cost objectives and a revitalized and more formal cost-performance tradeoff process will motivate both government and industry by clarifying objectives, fostering feedback, and empowering decision making at the lowest level practicable. For fielded systems that are well past their acquisition phase, additional incentives may be needed to re-engineer and retrofit older, costly design features. Two approaches are recommended: (1) establishment of a mechanism to encourage high-leverage system modifications to lower operating costs, and (2) a formal awards board to reward both individuals and organizations for innovations that reduce acquisition or support costs.

Metrics and Observables

To achieve the stated objectives the group has identified key metrics and observables to ensure that CAIV principles are implemented and that programs incorporate appropriate risk management measures. Accordingly, these tailored measures include setting cost objectives, adhering to the cost-performance tradeoff process, empowering program managers to make timely decisions, encouraging similar industry practices, and tailoring to commercial standards (when adequate).

Summary

In summary, the group proposes a new, top-down emphasis that integrates already-initiated and proposed acquisition process improvements with existing proven practices. A major finding by the group in conducting this review was that, while few additional innovations could be found, integration and strengthened implementation of existing policies and processes, as discussed in this paper, should achieve the objectives of cost as an independent variable for the Department.

Introduction

This paper proposes a departmental strategy for acquiring DoD systems that will meet the future needs of our forces by providing robust capabilities that are based on more affordable program costs and attainable in shorter schedules. This strategy entails setting *aggressive*, realistic cost objectives for acquiring and supporting defense systems, and managing to achieve those objectives. Cost objectives must balance mission needs with projected out-year resources, taking into account anticipated process improvements in both DoD and defense industries. This concept has become known as "cost as an independent variable" (CAIV), meaning that, once the system performance and objective cost are decided (on the basis of cost-performance tradeoffs), the acquisition process will make cost more of a constraint, and less of a variable, while nonetheless obtaining the needed military capability of the system.

A key tenet of the CAIV approach is far greater *user* involvement in the process through participation in setting program goals throughout the program phases, particularly in the cost-performance tradeoff process. This paper refines the CAIV concept, and expands on guidance promulgated in the July 19, 1995, memorandum of the Under Secretary of Defense, Acquisition & Technology, (USD(A&T)), subject: "Policy on Cost-Performance Trade-offs." The principles outlined here will apply generally to all acquisition programs.

Conceptual Approach

Various acquisition reform efforts are now addressing aspects of the acquisition process that will reduce overall life-cycle costs. They include such initiatives as MilSpec reduction, Integrated Product and Process Development (IPPD) and Integrated Product Teams (IPTs), process maturity, business practice reforms, and--quite significant to CAIV--the shift to performance specifications. The approach, summarized below, is to utilize and enlarge on these initiatives to achieve the objectives of cost as an independent variable:

- Set realistic but *aggressive cost objectives* early in each acquisition program
- *Manage risks* to achieve cost, schedule, and performance objectives
- Devise appropriate *metrics* for tracking progress in setting and achieving cost objectives
- *Motivate and Incentivize* government and industry managers to achieve program objectives
- Put in place *for fielded systems* additional incentives to reduce operating and support costs

Cost-Performance Tradeoffs

Several programs, both today and in the past, have employed CAIV principles, including WCMD, JAST, JDAM, JASSM, PLGR, and New Attack Submarine. However, until very recently, our goal-setting processes have been largely driven by available technology and generally have not emphasized cost-performance tradeoffs in setting program goals. Furthermore, goals have been set on the basis of near-term budgetary needs--a reality--but not always in balance with life-cycle cost mitigation. By better connecting the user, supporter and developer, the proposed CAIV approach facilitates the process of making tradeoffs among performance, schedule, and costs. Establishing

tradeoffs empowers the user to make choices that provide the best performance for the money for each system, thereby helping to ensure maximum benefit from all systems across the force within the resources available.

The best time to reduce life-cycle costs is early in the acquisition process, and cost performance tradeoff analyses must be conducted before an acquisition approach is finalized. However, because external parameters change and program realities evolve, cost-performance tradeoffs must occur throughout the acquisition process. Life-cycle cost objectives should be incorporated in program requirements documents, RFPs, contract provisions, and the source selection process.

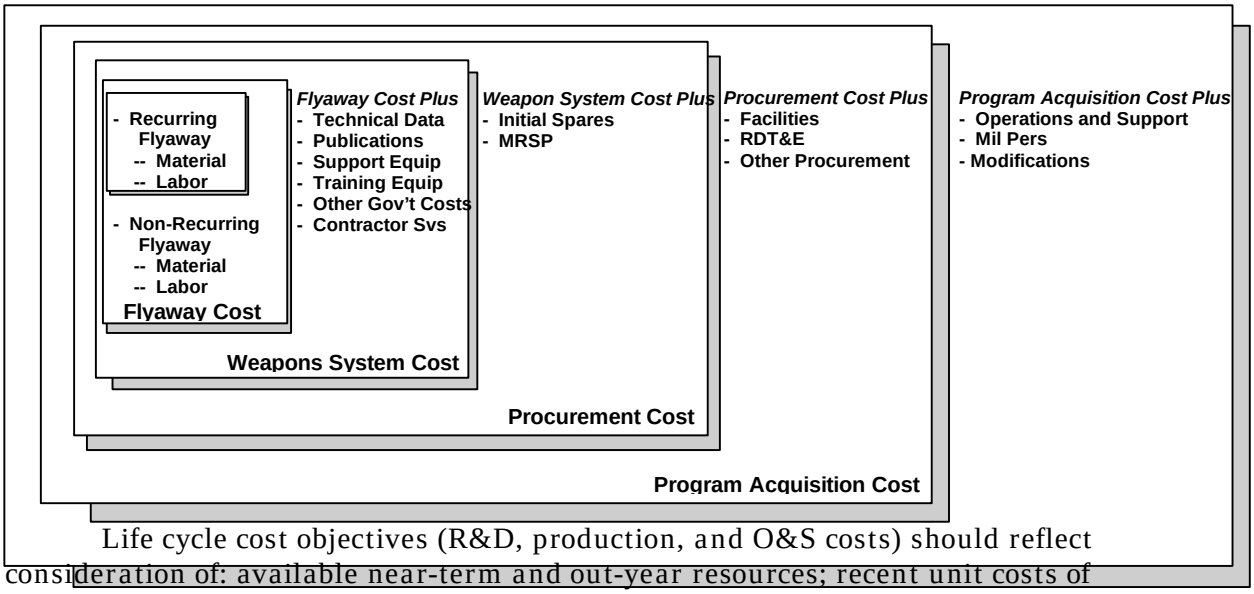
Maximizing Program Managers' and contractors' flexibility to make cost/performance tradeoffs without unnecessary higher-level permission is essential to achieving cost objectives. Therefore, the number of threshold items in requirements documents and the Acquisition Program Baselines should be strictly limited and the threshold values should represent true minimums, and requirements should be stated in terms of capabilities, vice technical solutions and specifications. RFP's should include a strict minimum number of critical performance criteria that will allow industry maximum flexibility to meet overall program objectives. Stating requirements in terms of overall military capability needed rather than as detailed design specifications is crucial in providing the necessary trade space and flexibility to implement CAIV successfully.

A major topic upon approval of a Mission Need Statement should be the approach and inputs used to set and refine cost objectives. At each milestone review, cost objectives and progress in achieving them should be assessed. There must be flexibility for adjustments and/or refinement in cost objectives. To assist in establishing program cost objectives and to facilitate cost-performance tradeoffs, the Overarching IPT (OIPT) for each Major Defense Acquisition Program will establish a Cost-Performance Integrated Product Team (CP-IPT) (as directed in the previously-referenced July 19,1995, memorandum of USD(A&T)). It is critical that the user community have representation on the CP-IPT. Industry representation, at the appropriate time, is also expected.

Setting Aggressive Cost Objectives

Aggressive cost objectives means costs objectives that are the "DoD-equivalent" of sound commercial business practices. They should be much lower than would be projected for a system using past ways of doing business in DoD. Reducing life-cycle costs (see figure 1) means focusing early on setting and managing to the production cost objective and assessing the impact of basic system parameters and early design decisions on O&S costs. Achieving aggressive cost objectives for the production and operating phases of a system's life may, in fact, occasionally require greater up-front investment during Demonstration/Validation (Dem/Val) and Engineering and Manufacturing Development (EMD) phases. Although lower up-front costs usually indicate simpler designs, and therefore correspondingly lower support costs, there may be cases where certain elements of early program costs may be higher than historical experience because of increased emphasis on product maturity exiting EMD and up-front investments to reduce O&S costs.

Figure 1. Definition of Life-Cycle Costs



Life cycle cost objectives (R&D, production, and O&S costs) should reflect consideration of: available near-term and out-year resources; recent unit costs of comparable or fielded systems; parametric estimates; mission effectiveness analysis and trades; technology trends; and use of innovative manufacturing techniques and commercial business practices. Early cost objectives should be challenging but realistic and should be defined as ranges. Aggressive cost objectives will typically entail risks; however, process maturity, aggressive management (under a more failure-tolerant philosophy), and other initiatives should result in lower overall risk.

Production cost objectives should be expressed in terms of some reasonably stable measure, such as an early fixed production quantity (e.g., the first production lot), to eliminate variations due to future changes in the quantities planned or actually produced. (For some programs, it may be appropriate to specify the objective in terms of "first production unit cost.")

Both commercial and defense industries are adopting new design, manufacturing and management processes that offer the potential to reduce development and production times and costs substantially over previous processes. We are stressing increased reliance on commercial business and technical practices and benchmarking commercial processes to define equivalent cost-saving processes for military systems. If given the right incentives and room to make design tradeoffs, industry management and engineers working in IPTs can institute process improvements and system designs that produce products with inherently lower production and operating and support costs and which might be fielded sooner.

Risks in achieving both performance and aggressive costs goals must be clearly recognized and actively managed through continuing iteration of cost/performance/ schedule/risk tradeoffs, identifying key performance and manufacturing process uncertainties and demonstrating solutions prior to production. Risk reduction through use of mature processes should be a significant factor in source selection, since the production cost objective can only be achieved by demonstrating and bringing to maturity key manufacturing processes. Whereas DoD has traditionally managed performance risk, there must be an equal emphasis on managing toward cost and supportability goals. Cost and risk management involves constructing a plan and schedule of events and demonstrations

to verify solutions to cost/risk problems. It further involves unit procurement and O&S cost tracking models that will update cost predictions based on observed events and metrics as program progress. Table 1 contains examples of illustrative cost factors and indicators that can contribute to assessing cost objective achievement.

Table 1. Illustrative Factors and Indicators in Reducing Cost Risks

Factor	*Indicators*
• Design Simplification (Mission/Complexity)	- Mission simulation complete - 80% solution analysis complete
• Mature Manufacturing Processes (Cost/Yield)	- Scaleable process demo-ed - Statistical process controls in place
• Technology (cost trends, cost/performance)	- Product available - Market prices established
• Effective Integration (Errors/Redesign)	- 100% 3-D product model exists - Test articles available - Software available
• Commercial Processes and Components (Cost/Performance)	- Environmental suitability established
• DoD Prototype	- Integration verified
• Elimination of (unnecessary) DoD Unique Business Practices	- Low-cost business processes employed

Incentives For Achieving Cost Objectives

We should motivate higher-level managers, program managers and industry to innovate and accept increasing risks, and then reward them for achieving their objectives. Most importantly, we must not penalize them if failures occur, despite best management efforts. We also must promote Congressional acceptance of this new way of doing business, even though open identification of risks might be used by those opposed to a program. Two new incentives concepts are also outlined below.

Motivating Government Managers *:* In the past, guidance to program managers have frequently not stressed up-front investments to minimize production and O&S costs. In the early phases, the program manager needs the encouragement of the users, CAEs and DAE to accept risks associated with aggressive cost objectives, and promotion policies must recognize and reward good tries as well as successes. Headquarters must accept risk taking (while promoting risk management) when the potential payoffs are high. In the later phases, the DAB and Component reviewers should enforce all aspects of life-cycle cost reduction, with increasingly specific exit criteria (identified in Acquisition Decision Memoranda) as the program evolves.

Effective top-level management should motivate managers and workers at every level to perform as desired by clearly identifying objectives and by fostering a positive "can-do" attitude from top to bottom. Promotion policies, awards and other formal recognition are important in providing feedback that jobs have indeed been done well. However, by far the best incentive for government managers is an environment that promotes goal setting, teamwork, and recognition of accomplishments from the management chain.

Motivating Industry : Motivating and incentivizing industry must center primarily on ensuring competition to win business along with attendant business profit in all phases of a program's life cycle.

Current practices frequently provide little or no industry incentive to reduce long-term costs to the government. Source selections all too frequently emphasize (near-term) performance, with less attention given to life-cycle costs. However, contractually incorporating production and life-cycle cost objectives and providing for a sharing of the savings when costs come in below objectives creates a "win-win" situation for all. The following tools and techniques are available to motivate contractors to reduce costs:

Competition: At both prime and sub-tier levels, the government should use competition for as long as reasonably possible. The government has maximum cost leverage when there are competing concepts or producers. In many cases, this means continuing competition as far into the acquisition cycle as practical and affordable, keeping open the option of re-starting competition in the production phase. (This must be planned for early in the acquisition process.) Therefore, cost objectives should be included in all RFPs, and the government should apply the results of cost/performance tradeoffs in contracts early in the process, preferably before down-selection. For industry, the early incentive is to win the business through the most credible solutions to the RFP problem statement that appear capable with acceptable risks of achieving specified cost objectives. Thus, contractors should be encouraged by program managers to incentivize sub-tier vendors to assist in cost reduction efforts, both through competition and other incentives.

Maximum use of open systems concepts at all levels can greatly facilitate having opportunities for continuing competition throughout program lifetime.

When it is no longer practicable to maintain real competition for a system, some of the benefits of competition can still be obtained through competition among acquisition programs within the same mission area for available funds in the PPBS process.

Shared Savings Incentives: Value Engineering provides rebates of substantial percentages of savings to the contractor. Current obstacles to the use of value engineering include long administrative approval times and concerns over the possibility of product gaming. Judicious setting of objectives and thresholds under CAIV are needed to overcome these obstacles.

Contract Incentives: Well-structured contracts and well-designed contract incentive clauses are key in focusing contractor attention on cost reduction. The following considerations apply in the different stages of acquisition:

- **Development:** In early design with multiple concepts, competition is the government's strongest tool. The design and development contracts should include cost objectives for production and life cycle costs and require the accomplishment of cost/performance tradeoffs. The source selection criteria communicated to industry should reflect the importance of developing a system that can achieve stated production and life cycle cost thresholds. We need credible models to track projected unit production cost and O&S costs through development and into production.
- **Production:** A focus on first production lot quantities removes the effect of later quantity changes and can emphasize initial quality. When appropriate, an arrangement should be included in the contract that provides the contractor with a share of the cost savings for bringing the program in at or below

objective price. Care must be taken not to sub-optimize the first production lot cost at the expense of O&S costs. For later production lots, the objective is to incentivize continued cost reduction throughout the production phase. When practicable, as discussed above, competition can be introduced if unwarranted price increases occur. Other tools that would further reduce costs during production include multi-year procurement contracts, component breakout, and value engineering-type clauses.

- **O&S**: Incentives during early production and follow-on could be in the form of repair warranties with the contractor, or alternatively (possibly deferred payment) incentive fees could be tied to the R&D or production contracts. Since O&S costs are not easily measurable in the early stages of the acquisition process, incentives to reduce O&S costs may require a (validated) model that relates specific design parameters to measurable and predictable O& S costs. Reliability and maintainability characteristics, which are more readily measured and projected, might serve as early indicators of progress towards meeting O&S cost objectives. In any event, DoD needs better cost models for the O&S phase of our programs. We face the challenge that CAIV may involve incentivizing savings and cost avoidances that will only be realized in the more distant future.

A catalog of contract incentive techniques is being developed and will be made available on-line in the Acquisition Deskbook. Systematic analyses of successful techniques for incentive design at each stage of the process is necessary.

Incentives for Fielded Systems. Two new programs should be implemented. The first is to institute an *awards program* to recognize valuable suggestions toward reducing life-cycle costs. A board will be established to review nominations for the awards, which should be made at least annually. A second new incentive program would be established to encourage Component funding of high-leverage proposals for investments to reduce future life-cycle costs. Annually, the proposals should be ranked by projected, validated return on investment, risk, and other considerations. Participants from both Government and industry should be encouraged to compete for these resources. A suitable mechanism to fund as many worthy proposals as possible should be implemented.

Metrics and Observables

It is critical to CAIV that the process of setting cost objectives begin as early as possible. The ability to set and achieve aggressive cost objectives depends significantly on early tradeoffs in performance versus costs. Metrics and observables are needed for an overall assessment of progress in applying CAIV to a collection of programs; to DAE/CAE oversight of CAIV implementation; and to execution of the program. Illustrative metrics and observables are shown in Table 2. In general, these identify important and observable steps which should be implemented in setting aggressive production and O&S cost objectives and then managing for their achievement. In some cases, quantitative metrics may be applied, indicated by the parentheses at the end of a process step. Specific risk reduction steps for manufacturing, performance, manpower utilization, etc., should be addressed by other metrics and observables. Implementation should be tailored for specific programs.

Table 2. Illustrative CAIV Metrics and Observables

• Are cost objectives defined and consistent with requirements programmed and projected fiscal resources?	- Out-year resources identified? ($) - Production and O&S cost objectives included in the RFP? - Key tradeoff issues addressed? (e.g., in COEA)
• Is DoD managing to achieve cost objectives?	- RFP contains a strict minimum number of performance specifications? (#) - CP-IPT functioning; tradeoff space identified in program baseline and RFP? - Risks to achieve cost objectives identified and program steps to address these defined? (risk plan) - Incentives for achieving cost objectives included in the RFP and contract? (% relative to total contract $'s) - Mechanism for contractor suggestions to reduce production and O&S costs in place and operating? - Allocation of cost objectives provided to IPTs and key suppliers - Measurement and estimation of reliability and maintainability - Robust contractor incentives plan in place?
• Are contractors managing to achieve cost objectives?	- Providing appropriate tools for cost-performance tradeoffs (including incentives for corporate management) and participates in cost-performance tradeoff process - Identifying (and when appropriate implements) new technologies and manufacturing processes that can reduce costs - Identifying procedural/process impediments to cost reduction measures - Establishing strong relationship with vendor base, including sound incentives structure