START

Selected Topics in Assurance Related Technologies

Volume 5, Number 2

Cost As An Independent Variable (CAIV)

Introduction

Cost as an Independent Variable, or CAIV, is defined in Section 3.3.4 of DoD 5000.2-R, as:

> ". . . a process that helps arrive at cost objectives (including life-cycle costs) and helps the requirements community set performance objectives. The CAIV process shall be used to develop an acquisition strategy for acquiring and operating affordable DoD systems by setting aggressive, achievable cost objectives and managing achievement of these objectives. Cost objectives shall also be set to balance mission needs with projected out-year resources, taking into account anticipated process improvements in both DoD and defense industries."

CAIV in the Department of Defense is the equivalent of best commercial business practices in the private sector. In that sector, companies continuously work to reduce acquistion and life-cycle costs in response to competitive pressures for quality products, budget-constrained customers, and the market need to develop long term, stable client/customer relationships.

Background and Concept

As defense budgets have shrunk, DoD and service leaders have doubled their efforts to find more effective means of acquiring modern weapons at an affordable cost and in less time. Under Acquistion Reform, their efforts have resulted in standardization reform, use of commercial off-the-shelf (COTS) equipment, and the Single Process Inititative, to name a few. Making cost a truly independent variable in the acquisition process is another important part of their efforts. An essential part of the CAIV concept is a strong user role in setting and adjusting program goals throughout the acquisition process. This user role is especially important in making trades between cost and performance. Such trades are not new. What is new is the impetus behind them. In the past, they were primarily driven by a single, well-defined and dangerous threat and the technologies available to meet the threat. With the demise of the Soviet Union, the United States faces increasingly asymmetrical threats involving terrorism, rogue nations, and weapons of mass destruction in the hands of third-world countries. Coalition warfare has become a more frequent and probable mode of operation. And we must still be able to unilaterally fight conventional enemies with conventional weapons while maintaining a still-sizable nuclear deterrent.

At the same time that the threat has changed, funding for defense has dropped markedly. CAIV is just a part of the overall strategy for acquiring affordable systems needed to counter the new threats. Achieving the goal of making cost an independent variable in acquisition requires the DoD and military services to take the following actions:

- Set realistic but aggressive cost objectives early in each acquistion program
- Manage risks to achieve cost, schedule, and performance objectives
- Devise appropriate metrics for tracking progress in setting and achieving cost objectives
- Motivate government and industry managers to achieve program objectives
- Develop incentives for reducing the operating and support costs for fielded systems

CAIV versus Design to Cost

At first glance, CAIV may appear to be equivalent to another concept, Design to Cost (DTC). Certainly, similarities exist. Both are intended to control costs. Both require trade-offs. Both are implemented during the acquisition of a system. There, the similarities end. The primary focus of the DTC program is on the projected average unit procurement costs. Projected operations and support (O&S) cost objectives receive only secondary attention. Officially, DTC was supposed to identify drivers of downstream costs for specific weapons systems, to do so early in the life of that acquistion program, and to consider ways to keep those costs under control. In practice, DTC focuses on controlling near-term costs. Few incentives are given to spend development funds to reduce production and O&S costs. Trades are usually a case of reducing requirements to stay within a unit production cost target.

CAIV, on the other hand, is clearly aimed at managing to a life cycle cost objective. Furthermore, under CAIV the objectives of trade-offs are more ambitious and sophisticated. As articulated by Dr. Jacques Gansler, Under Secretary of Defense for Acquisition and Technology, at a 1998 conference[1], "CAIV is not intended to force 80% solutions in order to stay within a cost ceiling; it is intended to force better ways to get a 100% solution within the cost

ceiling." At times, relaxing one or more requirements may be the only way to stay within the cost. Nevertheless, working with the contractor to find innovative ways to achieve the required performance within the cost ceiling is clearly the first priority. Other Acquisition Reform initiatives are intended to provide contractors with the flexibility and motivation to innovate. Clearly, the various initiatives, including CAIV, support each other, and all are needed to achieve the goal of affordable, superior systems.

Under CAIV, it is important to include the user, support, and acquisition communities on the acquisition team. A principal goal of the team should be to avoid investments that yield a poor return. An example of such an investment might be striving to achieve a performance goal, the final five percent of which drives fifty percent of the cost. Dr. Gansler's predecessor, Dr. Paul Kaminski, noted that setting the cost is more involved than simply determining the price the market will bear and subtracting the profit margin. He described the past concern with cost as one of looking at cost after 80% of it had already been determined (see Figure 1). He proposed that representatives of the financial community be involved early, and that cost, performance, design, and schedule be evaluated together throughout the acquisition process. Cost, schedule, and performance need to be "owned" by the entire acquisition team.

To maximize the benefits of CAIV, some proponents recommend defining system performance parameters in terms of thresholds and objectives, thereby establishing a trade space (Figure 2). Thresholds are the minimum acceptable system characteristics/ capabilities or Key Performance Parameters (KPP) or Critical Performance Criteria. Objectives include desired characteristics and capabilities above the thresholds. Trade space allows offerors, in response to a Request for Proposal, the flexibility to propose the maximum number of objectives over the KPPs but still within the CAIV cost objective.

Implementing CAIV

Implementing the five actions described earlier (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 government and industry managers to achieve program objectives; and develop incentives for reducing the operating and support costs for fielded systems) is neither simple nor easy.

Perhaps the most challenging of these actions is motivating managers to achieve life cycle cost goals when doing so requires up-front investments to minimize production and O&S costs. Program managers must have the proper incentives to take the inevitable risks associated with the innovation necessary to meet performance requirements within aggressive cost objectives. In this regard, promotion policies, awards, and other forms of recognition, as well as effective training and guidance, are important. Most important is an environment characterized by goal setting, teamwork, and continual recognition of achievement by management leaders.

For Further Study:

1. Web Sites: Additional information on CAIV can be obtained from the following websites. In addition, many of the publications in the list that follows can be downloaded from these sites:
   a. http://av.yahoo.com/bin/query?p=caiv&z=2&hc=0&hc=0 ("Yahoo" query on CAIV)

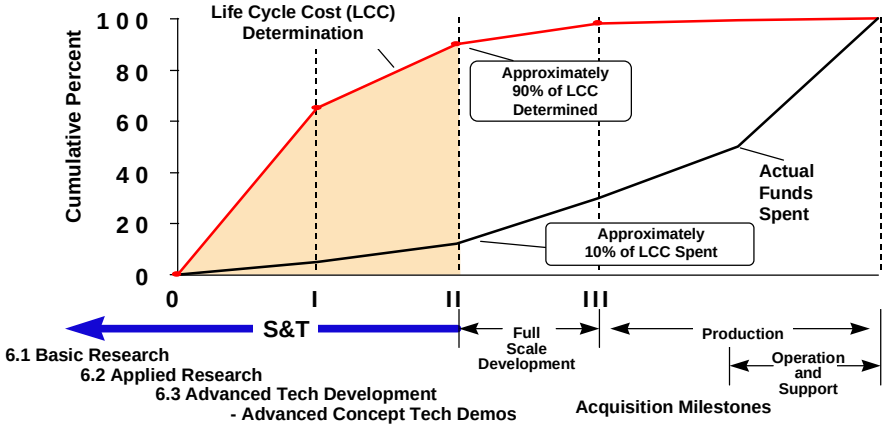

Figure 1. Life cycle costs are determined early in a product's development

[1]"Acquisition Reform for the Long Haul," Hyatt Hotel, Crystal City, VA, 2-3 February 1998.

CAIV Focuses on the "Knee of the Curve"

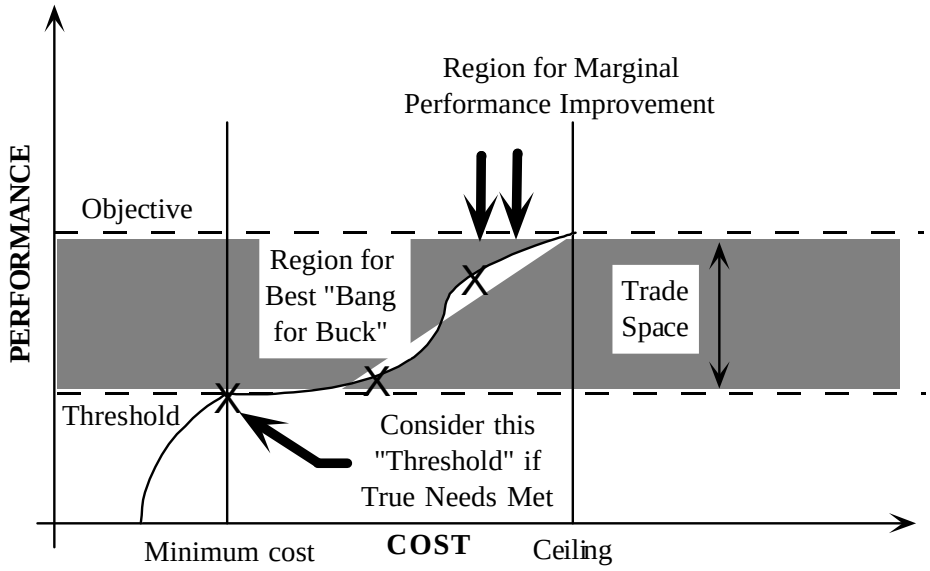

Figure 2. Trade space provides flexibility

b. http://www.safaq.hq.af.mil/acq_pol/
c. http://www.monmouth.army.mil/cecon/ac/arp/arp28.html
d. http://aegis.dynsys.com/acqref.html
e. http://www.acq.osd.mil/api/asm/caiv.pdf
f. http://www.monmouth.army.mil/cecom/pae/caiv/links.htm
g. http://www.afmc.wpafb.af.mil/HQ-AFMC/DR/dri-home/acqref/aqustrat/caiv_ex.htm

2. Publications:
   a. "CAIV - An Important Principle of Acquisition Reform," by Capt. Guy Higgins, USN Program Manager Magazine, Jan. - Feb. 1997.
   b. "Controlling Costs - A Historical Perspective," by B.A. "Tony" Kausal IV, DSMC Program Manager Magazine, Nov. - Dec. 1996.
   c. "Cost an an Independent Variable," CAIV Working Group Paper, 16 July 1996.
   d. "Cost as an Independent Variable (CAIV) and Nondevelopmental Variable," by J. Gerald Land, Program Manager Magazine, Mar. - Apr. 1997.
   e. SAF/AQ Memo, "Implementing Cost as an Independent Variable," 12 Mar. 1997.
   f. "Some Potential Benefits of Using CAIV in Defense Programs," by Dr. Edmund H. Conrow, Program Manager Magazine, Nov. - Dec. 1996.

Other START Sheets Available:

94-1	ISO 9000
95-1	Plastic Encapsulated Microcircuits
95-2	Parts Management Plan
96-1	Creating Robust Designs
96-2	Impacts on Reliability of Recent Changes in DoD Acquisition Reform Policies
96-3	Reliability on the World Wide Web
97-1	Quality Function Deployment
97-2	Reliability Prediction
97-3	Reliability Design for Affordability
98-1	Information Analysis Centers

To order a free copy of one or all of these START sheets, contact the Reliability Analysis Center (RAC), 201 Mill Street, Rome, NY 13440-6916. Telephone: (888) RAC-USER. Fax: (315) 337-9932. E-mail: rac@rome.iitri.com. These START sheets are also available on-line at http://www.rome.iitri.com/RAC/DATA/START in their entirety.

Future Issues:

RAC's Selected Topics in Assurance Related Technologies (START) are intended to get you started in knowledge of a particular subject of immediate interest in reliability, maintainability and quality. Some of the upcoming topics being considered are:

- Commercial Off-the-Shelf Equipment
- Accelerated Testing
- Mechanical Reliability
- Software Reliability

Please let us know if there are subjects you would like covered in future issues of START.

Contact Anthony Coppola at:

Telephone: (315) 339-7075
Fax: (315) 337-9932
E-mail: acoppola@iitri.org

or write to:

Reliability Analysis Center
201 Mill Street
Rome, NY 13440-6916

About the Author:

Ned H. Criscimagna is a Senior Engineer with IIT Research Institute (IITRI). At IITRI, he has been involved in projects related to Defense Acquisition Reform. These have included a project for the Department of Defense in which he led an effort to benchmark commercial reliability practices. He led the development of a handbook on maintainability to replace MIL-HDBK-470 and MIL-HDBK-471, and the update to MIL-HDBK-338, "Electronic Reliability Design Handbook." Before joining IITRI, he spent 7 years with ARINC Research Corporation and, prior to that, 20 years in the United States Air Force. He has over 32 years experience in project management, acquisition, logistics, reliability and maintainability (R&M), and availability.

Mr. Criscimagna holds a Bachelor's degree in Mechanical Engineering from the University of Nebraska-Lincoln, a Master's degree in Systems Engineering from the Air Force Institute of Technology, and he did post-graduate work in Systems Engineering and Human Factors at the University of Southern California. He completed the U.S. Air Force Squadron Officer School in residence, the U.S. Air Force Air Command and Staff College by seminar, and the Industrial College of the Armed Forces correspondence program in National Security Management. He is also a graduate of the Air Force Instructors course and completed the ISO 9000 Assessor/Lead Assesor Training Course. Mr. Criscimagna is a member of the Amercian Society of Quality (ASQ) and a Senior Member of the Society of Logistics Engineers (SOLE). He is a certified Professional Logistician, chairs the ASQ/ANSI Z-1 Dependenability Subcommittee, is a member of the US TAG to IEC TC56, and Secretary for the G-11 Division of the Society of Automotive Engineers.

About the Reliability Analysis Center

The Reliability Analysis Center is a Department of Defense Information Analysis Center (IAC). RAC serves as a government and industry focal point for efforts to improve the reliability, maintainability and quality of manufactured components and systems. To this end, RAC collects, analyzes, archives in computerized databases, and publishes data concerning the quality and reliability of equipments and systems, as well as the microcircuit, discrete semiconductor, and electromechanical and mechanical components that comprise them. RAC also evaluates and publishes information on engineering techniques and methods. Information is distributed through data compilations, application guides, data products and programs on computer media, public and private training courses, and consulting services. Located in Rome, NY, the Reliability Analysis Center is sponsored by the Defense Technical Information Center (DTIC). Since its inception in 1968, the RAC has been operated by IIT Research Institute (IITRI). Technical management of the RAC is provided by the U.S. Air Force's Research Laboratory Information Directorate (formerly Rome Laboratory).