STANDARD Missile Value Engineering (VE) Program

A Best Practices Role Model

Roland Blocksom

In mid 2002, the Office of Naval Research's Best Manufacturing Practices Center of Excellence (BMPCOE) reported a survey of best practices being used in the Navy's STANDARD Missile Program Office, currently a part of the Surface Weapons Systems/Launchers division of the Program Executive Office for Integrated Warfare Systems (PEO IWS 3A).

One of the areas highlighted in the STANDARD Missile Program Office survey was its use of a Value Engineering (VE) program that implements a highly successful VE change process with its STANDARD Missile production lines. The nominal return-on-investment (ROI) from the VE program was substantial when compared to others in the federal government.

This article recounts how the VE program arose, was nurtured in a team environment, and was implemented. It points to a number of lessons learned that have earned this program the label of "best practice" and illustrates why the Navy's STANDARD Missile Program Office has become a role model for similar VE programs in industry and government.

Tough Defense Budget Years Pose Missile Affordability Problems

By the mid 1990s, defense budget cutbacks—as much as 40 percent—were beginning to have a major impact on many government weapon procurement efforts. At the same time, mandated acquisition reform changes were beginning to be implemented within the Department of Defense (DoD). These reforms were intended to transform DoD into a more responsive and efficient buyer of best-value goods and services by focusing on a number of critical issues that included establishing total ownership cost reduction discipline and bringing cost engineering tools into play.

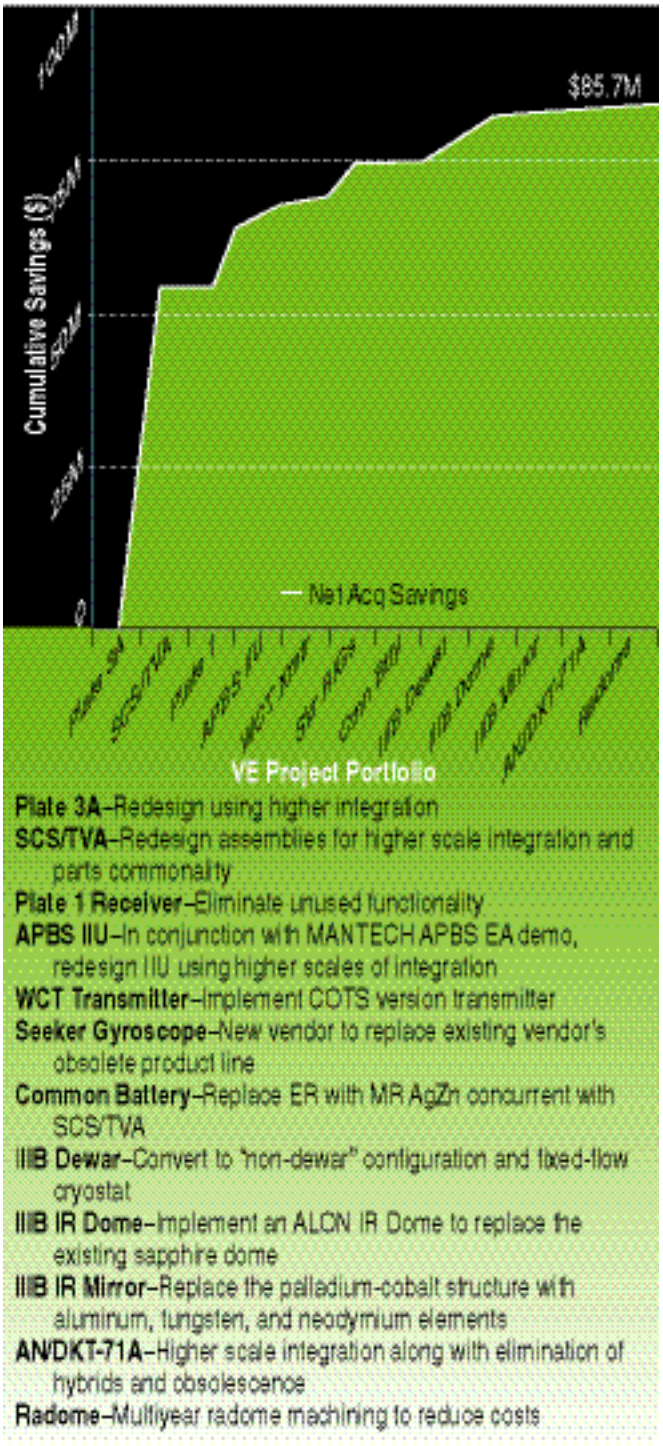
At the grass roots level, officials in the Navy's STANDARD Missile Program Office were beginning to see the unit price of missiles increase as the defense budgets decreased, yet they saw little change in the requirement for providing air defense missiles to the U.S. Navy Fleet.

Program Office Initiative Gets The VE Change Proposal (VECP) Process Rolling

By addressing missile unit cost reduction as a total ownership cost goal, the program office began designating cost as part of their engineering discipline. Program office leaders empowered an integrated product team (IPT) to work on three areas where they thought missile cost could be controlled: production, development, and lo-

Blocksom *is a retired Navy commander and currently a technical risk manager with WILLCOR, Inc., supporting the Navy's Best Manufacturing Practices Center of Excellence (BMPCOE).*

Budget Savings from the STANDARD Missile VE Program



gistics support. Of these three areas, production buys seemed to be the major cost driver. The team also concentrated on having the capability to trade performance for cost, as well as considering cost as a goal in evaluating new technology for the missile program. Realizing that engineering change was an integral and normative part of the acquisition process, the program office considered a strategy for using engineering changes as a cost reduction tool in missile production lines. The leaders reasoned that by establishing incentive in this process, both the government and its industry partners would benefit. They also reasoned that incremental performance improvements in block upgrades would reduce program risks, testing costs, and qualification requirements. At the same time, streamlining the process by relaxing detailed design control with the prime contractor would simplify the change process and help accomplish acquisition reform goals. The results of these strategy considerations became a highly successful VE change proposal (VECP) process—so successful, in fact, that the program office was able to save over $85 million through FY03, establishing the STANDARD Missile Program as a leader in federal VE efforts.

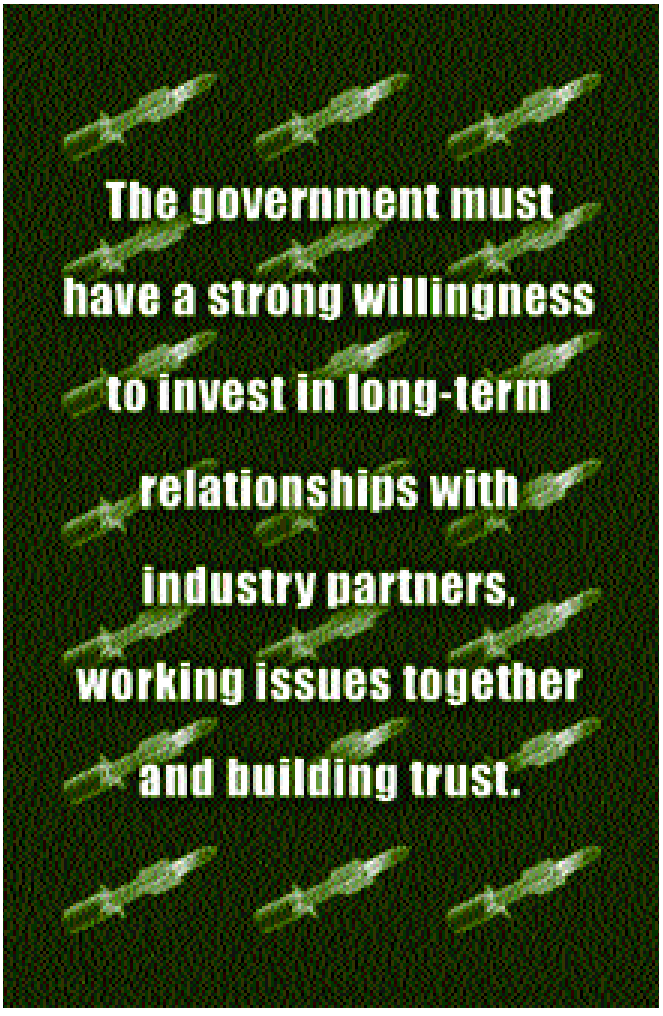
Flushing Out Successful Strategies for VECPs

The program office was faced with how to structure successful VECP strategies that were realistic and achievable from both a technical and a contracting process perspective. The program office determined that the most important strategies were to make optimum use of personnel resources, to streamline the procurement process, and to ensure well-designed technical improvements.

To optimize personnel resources, the program office focused on the important benefits that could be derived from a good government/industry partnering. This involved not only getting the program office and field activities to work together, but also integrating the contractor, Raytheon, into the team as a full partner. To streamline procurement, the program office ensured that the VECP process/approval cycle was well defined and understood at the start. In the technical arena, the program office had to consider a number of development/production impacts resulting from the potential VECPs.

Optimizing Development and Production Capabilities

VECPs are engineering changes to an existing design. The value part of the engineering change is any technical, material, or support change that has been proposed to the design to obtain its cost and performance value. The technical changes that the STANDARD Missile Program Office considered for missiles in production included replacing obsolete parts, designing changes for both new and backfitted missiles, and missile performance enhancements. Technical considerations also had to be made for ensuring the continued use of manufacturing sources, testability, incorporation of new technology enhancements, improved reliability, and commonality with other missile variants in production. These technical considerations were aided by design strategies that included not only product architectures across the STANDARD Missile family, re-use of proven designs, and controlled parts selections, but also considerations for use and mission applications by 13 foreign military sales (FMS) countries.



Government and Industry Partnering: A Win/Win Deal

According to Scott Reiter, then production manager for the STANDARD Missile Program Office, the key to achieving cost reductions using the VECP process was the concept of close government/industry partnering. Reiter emphasizes that the government must have a strong willingness to invest in long-term relationships with industry partners, working issues together and building trust. He cautions, however, that doing this doesn't mean giving away the store. Once the process was initiated, ideas for VECPs began to generate excitement as the process matured and showed return on investment. Reiter states that the government just couldn't have afforded the burden of going down this path by itself. Rich Leonard, the Raytheon business manager for STANDARD Missile Programs, agrees completely, saying that "the success of the VECP program has in large part been due to the close partnership Raytheon has had with NAVSEA [Naval Sea Systems Command] during the program."

A Streamlined VECP Process

Structuring and controlling the VECP process was one of the keys to success. Written ground rules and streamlining the approval chain and contracting process were extremely important. Nailing down share lines and agreeing with the prime contractor on contractual details were critical. Cost goals included splitting the share line 50/50 for a specified number of years, then structuring incentives for cost savings. The government didn't want to get into a share line negotiation cycle. Both the government and the contractor had a win/win situation.

Raytheon agrees that maintaining a formal process was key to the success of the partnership. Leonard comments that the communication of project process and expectations in the early stages of the VECP process was critical.

Program office relationships with the contracting officer were also a necessary part of the VECP process, according to Reiter. The contracting officer had to be on board with the details and not be a stumbling block to the process implementation, yet ensure that all the i's were dotted and t's crossed from a regulatory standpoint. The approval process needed to be streamlined but auditable. The timeline activities in the VECP process (proposal development, selection board cycle, contracting procedures, for example) had to be well known to all players. Cost proposals needed to be clear and able to be put under contract quickly .

Elements in the Structure of a Good VECP

A long, mature production line had already been established and was operating for the STANDARD Missile. When VE incentives were announced, it was not difficult for contractor personnel to produce viable VECP candidates. Ideas for VECPs were abundant. However, to be a good VECP candidate and a benefit to the Navy, the terms of cost savings and performance enhancement had to be well articulated, the engineering impacts had to be known at the beginning, and production schedules had to be well-managed to minimize overall cost impacts in the budgeting and contracting processes. Each of these elements required considerable organization as well as the formulation of metrics by which to evaluate the effort's success.

Referring to the importance of handling personnel resources in a successful VECP process, Leonard says, "We have been able to retain some of the most respected engineers within our division on STANDARD." He further notes that when mature programs don't offer such challenges as the successful STANDARD Missile VECP program, the project tends to lose critical engineering and operations personnel to new and more exciting programs.

The Metrics Tell the Story

Over the course of several years, the STANDARD Missile Program Office VE IPT evaluated many ideas for all the major subsystems of the STANDARD Missile. They ranged in scope from component/unit redesign and modified

STANDARD Missile

The STANDARD Missile is among the most reliable and effective weapon systems in the Department of the Navy's tactical inventory. It offers primary air defense support for the AEGIS *Ticonderoga*-class cruisers, the *Arleigh Burke*-class destroyers, and the navies of allied countries throughout the world. The evolving STANDARD Missile family provides a robust anti-air warfare capability—a defense against high altitude, long-range, high crossing, and maneuvering threats. The STANDARD Missile Program Office (IWS 3A) is responsible for the cradle-to-grave management of the STANDARD Missile. IWS 3A oversees all variants of the program, inclusive of concept formulation, design, development, integration, acquisition, test and evaluation, fleet introduction, modernization, and life-cycle maintenance.
Photograph courtesy of BMPCOE

production processes to commercial off-the-shelf (COTS) implementation and new vendor selection to address parts obsolescence issues. The cost reduction in individual VECPs ranged from $ 0.5 million to over $56 million. The chart on page 42 shows the VECP portfolio through FY03 illustrating the net reduction for the STANDARD Missile Program acquisitions.

Examples of Successful VECP Implementation

Three examples of successful STANDARD Missile VECPs tell the story: the Plate 3A AEGIS Transceiver Producibility VECP; the Warhead Compatible Telemeter (WCT) Transmitter (AN/DKT-71A); and the Autopilot Battery Section Inertial Instrument Unit and Electronics Assemblies (APBS IIU and APBS EA). But first, a few words are needed to understand these changes in terms of the weapon in which they were implemented. The STANDARD Missile, the Navy's premier surface-to-air, ship-based weapon, is a highly complex system composed of multiple modules, some of which control evolutions such as guidance and navigation, propulsion, staging, steering control, and warhead control. Module interfaces are highly defined, and module/component design is tightly controlled to produce this extremely compact and complex weapon. In addition, members of the STANDARD Missile family are usually variants of a well-honed design process that is upgraded in blocks and increments to add new performance capabilities or missile functionality. These features mean that any change to a missile variant can ripple through the production lines to other variants.

VECP Example #1: Plate 3A AEGIS Transceiver Assembly

The design link allowing communication from the missile to the AEGIS weapons system, implemented in the Navy's CG-47 *Ticonderoga* and DDG-51 *Arleigh Burke* cruiser and destroyer ship classes, was modified to include a higher component level of integration. The results of the modifications added new functionality, link sensitivity, improved reliability, nuclear hardening, and other performance enhancements. The higher scale integration implementation directly reduced the number of testable assembly test levels from 11 to seven. The overall contract saved the government $34 million in immediate and projected procurement costs.

VECP Example #2: Warhead Compatible Telemeter (WCT) Transmitter (AN/DKT-71A)

The AN/DKT-71A Warhead Compatible Telemeter Transmitter that controls telemetry signals to the warhead was a unique military design. The VECP for this assembly was replaced by a COTS transmitter that met or exceeded the performance capabilities required. The VECP eliminated hybrid designs and obsolete parts to improve performance. Implementing this type of change illustrates to the contractor the value of stipulating performance goals and not design. The VECP has saved over $3.6 million.

VCEP Example #3: Autopilot Battery Section Inertial Instrument Unit (APBS IIU) and Electronics Assemblies (EAs)

This VECP leveraged two APBS IIU efforts to save costs and time. The VECP facilitated an upgrade to the IIU in conjunction with funding from a Navy manufacturing

technology program demonstration on the APBS electronics assembly (APBS EA). The higher level of electronics integration implemented on the EA allowed a redesign of the inertial instrument unit improving overall missile reliability and commonality over the missile product line. The resulting savings from the government/Raytheon shared investments were about $50 million.

Lessons Learned from the VECP Process

The major lessons learned from the VECP work accomplished by the daring and innovative personnel of the Navy's STANDARD Missile organization and its prime missile contractor, Raytheon, are recognized as examples of acquisition best practices. Their implementation presents the program office's success as a best practices role model. The lessons are not rocket science, nor are they difficult to implement. They are merely wise implementation of time-tested and logical steps and processes that management can take to ensure that innovative and resourceful people deliver high-quality products to the military user on time and within budget. These lessons also reflect the implementation of the principles embodied in total ownership cost and good risk management techniques.

Government/Industry Partnering Fosters a Win/Win Situation

The successful VECP work carried out by the STANDARD Missile Program Office and Raytheon was a direct result of conscious decisions to build a government/industry partnering relationship. Both partners were willing to trust each other, to jointly invest their resources, and to commit to a long-term relationship whose keystone was the ability to jointly solve problems. The Navy's STANDARD Missile Program Office and Raytheon were, and continue to be, able to achieve this partnership.

Incentives are Good for Performance

A contract forms a basis for expectations and compensation. As dictated by the Federal Acquisition Regulation (FAR), contracts between the government and industry that exceed $100,000 must contain VE clauses for possible use when the contract is executed. However, if the government does not play a major role in motivating the contractor, the VE clause provisions may never be exercised. The government must take the initiative. Once implemented, the incentives attract the best performance from the personnel.

Write Down the Ground Rules

If the VECP process is to work smoothly, ground rules must be written early. Written expectations help the parties focus on how share lines will be structured, what investments are required by each party, how cost proposals are to be written and evaluated, how the approval process will proceed, and other key expectations and procedures. The Navy recognized at the beginning that they did not want to play games with share line negotiations and that good work warranted reward. The latter was well-recognized by the contractor as a good thing, and the result became a win/win situation. Knowing how to structure an effective proposal and having the process streamlined helps to get the program on the road.

Change is Continuous: Be Flexible

Even though long-term relationships exist, people, organizations, and processes change. The best practices business models developed for VECPs must be flexible enough to address these inevitable changes. Key to success are flexibility, innovative thinking, and good problem-solving skills by all parties on the team. Sometimes efforts just don't succeed, and return on investment is sometimes hard to predict. In all these efforts Scott Reiter cautions, "Stay away from the blame game."

A Role Model for Others

Through its highly successful and innovative Value Engineering Program, the STANDARD Missile Program Office has implemented the spirit and letter of Public Law 104-106 in "improving performance, reliability, quality, safety, and life cycle costs" and has distinguished itself as a role model and best practices leader in the federal government.

Editor's note: The author welcomes questions and comments. Contact him at roland@bmpcoe.org.