

IMPROVING QUALITY IN THE DEPARTMENT OF DEFENSE WITH VALUE ENGINEERING

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ABSTRACT

Historically VE was developed to find alternate solutions to problems associated with resource constraints. VE is now primarily viewed as a tool for reducing cost. This paper will discuss other reasons for applying VE and deriving the benefits from it.

QUALITY

Quality can be defined as meeting or exceeding a customer's stated or implied requirements for a product or service. Requirements usually include but are not limited to performance, availability, ease of use, reliability, maintainability, perhaps testability, and probably affordability. Quality can be attained through careful attention to the design, implementation, and verification of results for the selected product or service, process, and organizational structure.

DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures," defines Quality in the following three ways:

Quality of Design. The effectiveness of the

design process in capturing the operational requirements and translating them into detailed design requirements that can be manufactured (or coded) in a consistent manner."

Quality of Conformance. The effectiveness of the design and manufacturing functions in executing the product manufacturing requirements and process specifications while meeting tolerances, process control limits and target yields for a given product group."

Fitness for Use. The effectiveness of the design, manufacturing and support processes in delivering a system that meets the operational requirements under all anticipated operational conditions."

VALUE

Value is sometimes mistaken for quality but they are not the same. An operational definition of quality includes or at least implies an element of cost. Value is the balance of function with cost. While value does not equal quality, value represents a significant part of quality.

Value is meeting customer needs at an affordable cost. The customer needs solutions to their obligations, requirements, problems, or challenges. These solutions must be characterized by utility,

effectiveness, performance, operability, reliability, and availability. Costs are associated with acquisition, operation, maintenance, and conserving the environment. Affordable means within available resources. Value can be represented by the relationship of functional utility or capability to cost. Value is increased by increasing functional utility or capability, decreasing cost, or, optimally, both. VE seeks solutions that meet or exceed customer expectations, satisfying stated or implied requirements while conserving or reducing required resources.

VALUE ENGINEERING

Congressional interest in the utilization of Value Engineering throughout the Federal Government prompted the Office of Management and Budget (OMB) to issue Circular A-131, "VE," that describes VE in the following manner. VE is an effective technique for reducing costs, increasing productivity, and improving quality. It can be applied to hardware and software; development, production, and manufacturing; specifications, standards, contract requirements, and other acquisition program documentation; facilities design and construction. It may be successfully introduced at any point in the life-cycle of products, systems, or procedures.

VE is a management tool that can be used alone or with other management techniques and methodologies to improve operations and reduce costs. For example, the total quality management process can include VE and other cost cutting-techniques, such as Life-Cycle Costing, Concurrent Engineering, and Design-to-Cost.

VE contributes to the overall management objectives of streamlining operations, improving quality, reducing costs, and can result in the increased use of environmentally sound and energy-efficient practices and materials. The complementary relationship between VE and other management techniques increases the likelihood that overall management objectives are achieved.

In the DoD, VE has been used primarily as a cost cutting tool. In fact, the bottom-line and perhaps the only performance measure for the DoD VE Program is the cumulative cost savings and cost avoidances reported annually. Annual savings are typically over \$1 billion; FY 1987 savings topped \$3.2 billion. These savings or cost avoidances are produced in one of two ways. VE Proposals are internal efforts that are undertaken by government personnel or

contracted out. These efforts usually result in cost avoidances with the benefits reverting wholly to the government. VE Change Proposals (VECPs) are submitted by defense contractors who propose a change to their current contract that will save the government money. These efforts normally result in cost savings with the net savings being backed out of the contract that are then shared between the government and the contractor.

HISTORY

VE originated in industry during the early stages of the World War II industrial mobilization efforts. The main motivation then was the scarcity of the raw materials needed to build the thousands of tanks, airplanes, and ships necessary to support our war effort. Steel, cooper, brass, rubber, and many other basic materials, including wood, could not be procured in sufficient quantities to meet the production needs of an ever-expanding Army and Navy.

A possible solution was determining if materials other than those specified in the original design specifications could be substituted. In many cases substitute materials could be used without degrading the function and performance expectations of the components or products. While this technique was not the sole solution to acquisition and logistical problems of the day, it was one of the techniques that proved very successful.

After the war, certain proponents of this technique saw that it could be used for other purposes besides meeting production schedules. The three classic elements of any successful program are performance, schedule, and cost. With the war over, these proponents chose to use their new found analysis technique on the element of cost. They felt that if an alternate material, process, or component could be found that worked just as well but was less expensive, then the overall cost of production could come down. The business side of the companies quickly saw the potential marketing advantages if the cost of production could be brought down. It would allow them to increase their profit margin on each sale or they could pass the reduced cost through to the consumer and thus hope to increase market share.

OPPORTUNITIES AND BENEFITS

Shortly after the DoD established its program, a study was conducted to determine the predominant sources of opportunity for VE¹. The object was to determine the range and degree of application. This study identified seven factors that were responsible

for 95% of the savings. Predominant were excessive cost (accounting for 22% of the savings), additional design effort (14%), advances in technology (23%), and questioning of specifications (inappropriate, out-of-date, or overspecified - 17%). These factors did not suggest that the original design was substandard.

Another study conducted by the American Ordnance Association (now the American Defense Preparedness Association) found that VE not only saved money but improved many other characteristics². Of the VE changes surveyed, reliability was improved 63% of the time, maintainability (64%), producibility (82%), human factors (58%), parts availability (58%), production lead time (78%), quality (parts meeting specifications 71%), weight (lighter 37%), and performance (33%).

CURRENT APPLICATION

The application of VE principles can help Defense Industry transition to dual-use production, become competitive in the commercial arena, and capture greater market share. A December 21, 1992, Business Week article, "Overhaul in Japan," talks about how extensively the VE methodology is used throughout the most competitive Japanese companies. It is used during the design phase where it is coupled with the Design-to-Cost discipline to manage toward cost targets determined by addressing customer affordability considerations. It is also used to continuously improve both products and manufacturing processes. The Society of Japanese Value Engineers has said that the primary focus of their VE efforts is to improve their products, increasing customer satisfaction, and thus increasing market share. Reducing cost is only a secondary aim but a common result.

In the DoD, VE has traditionally focused on high-rate production systems acquisitions. Due to a new defense acquisition environment that reflects the downsizing of force structure, there will be smaller production runs and increased emphasis on developing technologies for future use along with their essential associated process capabilities. This environment means VE efforts must seek new areas of opportunity other than the traditional unit production cost reduction that took advantage of the long high-rate production runs that we enjoyed in the past.

One such opportunity is in developing creative ways to reduce lifecycle costs by improving our supply, support, and development systems.

A recent proposal suggests using the VE contract incentive structure to help transition from military to commercial specifications and standards. The Deputy Under Secretary of Defense for Acquisition Reform chartered a Process Action Team to develop a strategy and a specific plan of action to decrease reliance, to the maximum extent practical, on military specifications and standards.

One recommendation in the team's report, "A Blueprint for Change," is that contractors be encouraged to propose alternative non-government standards and industry practices that meet the intent of the military specifications and standards cited in new and existing contracts. The report recommended that the "No Cost Settlement Method" for VE Change Proposals be used as a vehicle to incentivize contractors.

Another new area of opportunity is software. The Director for Acquisition Program Integration expressed concerns about the need to rein in software development costs saying in a memo to Service Acquisition Executives, Program Executive Officers, and Program Managers, "Software has clearly become a major cost, schedule, and performance driver of virtually all of our weapons, command and control, and information systems."

At the Army Communications-Electronics Command, the VE Office has joined forces with the Center for Software Engineering and undertaken a project to apply the functional analysis aspects of VE to this problem as well as incentivizing contractors to do the same through the VE change clauses of the Federal Acquisition Regulation.

OMB Circular A-131 has directed that VE studies seek environmentally sound and energy efficient alternatives as well as cost in all construction projects. Environmental and energy conservation preserves precious and limited resources but also translates into reduced life cycle costs.

RECENT MULTIPLE BENEFIT VE ACCOMPLISHMENTS

With over \$1 billion in savings annually, the DoD has obviously had many successes, many that did more than exclusively reduce unit cost. At the Army Communication-Electronics Command, GTE submitted a VE Change Proposal on the Mobile Subscriber Equipment System which reduced size and improved reliability and maintainability. The weight was reduced by 56%. The redesigned transmission

interface module integrated three functions by incorporating printed circuit cards. The net savings to the Army was \$11 million.

The Navy Standard Attitude Heading Reference System Program replaced three mechanical gyros with one laser gyro reducing unit production price by \$163,000 or 61%. This change reduced the input power requirement by 25% and weight 25%. The change was transparent to the user and had potential for multi-Service application. The projected savings to the DoD is \$5 million.

The Air Force was under significant pressure to reduce unit production cost to \$350,000 and total program cost by \$1.8 billion on their Advanced Medium Range Air-to-Air Missile Program. They naturally sought the help of VE. To date they have incorporated 42 VE Change Proposals and reduced unit production cost from \$500,000 to \$390,000.

Even with this focus on unit cost reduction, there has been significant improvements in reliability, maintainability, and supportability. These VE efforts have been so successful that the unit production cost target has set below \$300,000 and the total program cost reduction to \$2.0 billion.

The Defense Logistics Agency supporting the Marine Corps Light Armor Vehicle Program improved the vehicle heat blanket and reduced the unit cost by \$309. In addition, the replacement interval was extended by a factor of four. The operations and support cost avoidance is projected at \$13.6 million.

CURRENT DOD INITIATIVES TO EXPAND SCOPE AND UTILIZATION OF VE

Executive Steering Group

The Under Secretary of Defense (Acquisition and Technology) established the DoD VE Executive Steering Group (ESG). The ESG is chaired by the Deputy Assistant Secretary (Production Resources) and consists of senior executive level representatives for each Service and Defense Agency. They have been tasked to develop a comprehensive, coordinated, but realistic, DoD VE program reducing nonessential program and acquisition costs, reflecting the policies outlined by OMB, and identifying and committing required resources.

A draft charter directs the Executive Steering Group to serve as the executive agent for the Under

Secretary of Defense (Acquisition and Technology) for VE within the Department and be responsible to:

- Define the role of DoD VE within the current Defense atmosphere and develop the appropriate DoD VE program to fulfill this role.
- Provide guidance and direction on implementing the DoD VE program to the Services, Defense Agencies, and the defense industrial base.
- Develop comprehensive, coordinated, realistic DoD VE program plan.
- Ensure annual DoD VE program plan supports Service and Defense Agency objectives, and missions and can be supported by each Service or Defense Agency's resources.
- Identify Service and Defense Agency resource requirements and provide to the DoD Comptroller for annual DoD budget submitted to OMB.
- Approve uniform policies, procedures, and reports.
- Charter ad hoc VE Process Action Teams (PATs) and designate PAT members as necessary.
- Promote the use of the VE methodology in support of other DoD product, process, and service improvement initiatives.
- Serve as the Selection Board for DoD VE Achievement Awards presented annually by the Deputy Secretary of Defense.

Meetings will be scheduled as necessary, approximately 3-4 annually. The meetings will be decision-making to reach consensus, among the Office of the Secretary of Defense, Services, and Defense Agencies, on common DoD procedures that effect all and on how to most cost-effectively employ the DoD VE Program to maximize product, process, and service improvement benefits to the Department.

It has been proposed that the DoD VE Executive Steering Group hold an upper management VE review for the Under Secretary of Defense

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facilities design and construction.

Quality Management Board

The DoD VE Quality Management Board (QMB), consisting of the OSD, Service, and Defense Agency VE Program Managers, is a working group that serves as the implementing arm for the ESG. The QMB is working on: FY 1995 DoD VE Plan; marketing brief on VE for the ESG explaining what VE is and showing some of the benefits in participating; action plan for increasing major system program and contractor VE participation; developing VE benefits metrics in addition to dollars saved; FY 1994 annual VE report to OMB; and nominations for the 1995 DoD VE Achievement Awards.

Program Plan

The DoD VE Quality Management Board has drafted a DoD VE Plan for FY 1995. The Goals are:

Goal 1.0. Develop consistent DoD VE results-oriented focus for FY 1995:

- 1.1. Implement the guidance in OMB Circular A-131 consistently throughout DoD
- 1.2. Build cohesive integrated DoD VE Management Structure
- 1.3. Establish VE program funding
- 1.4. Improve VE Program Assessment Tools
- 1.5. Encourage expansion of VE

Goal 2.0. Increase VE benefits for 1995:

- 2.1. Increase acquisition cost savings and cost avoidances from Contractor developed VE Change Proposals as per FAR Part 48. FY 1995 savings goal will be established at 1% of Total Obligational Authority.
- 2.2. Increase cost savings, cost avoidances, and other benefits from VE Proposals developed by DoD military or civilians, or VE consultants. FY 1995 savings goal will be established at 1% of Total Obligational Authority.
- 2.3. Increase cost savings, cost avoidances, and other benefits from VE activities applied to

Goal 3. Increase VE Expertise

- 3.1. Develop VE competencies and training requirements
- 3.2. Identify, catalog, and assess VE training sources (DoD, federal, commercial)
- 3.3. Improve support to VE implementers

Special Awards

The DoD VE QMB established special awards to be recognized during the 1995 DoD VE Achievement Awards Ceremony. These special awards recognize outstanding DoD initiated VE Proposals (VEPs) or contractor submitted VE Change Proposals (VECPs) which demonstrate innovative approaches and applications and expand the benefits of VE beyond traditional hardware and construction cost reduction scope (e.g., improvements in: software, environmental concerns, energy conservation, organization/process/service improvements, performance, reliability, other quality improvements, etc.). The special awards will be competitive among Services and Defense Agencies. VEPs/VECPs worthy of this special recognition may be drawn from those approved and implemented during the last five fiscal years.

Investment Fund

As part of the FY 1995 DoD VE Program Plan, the QMB initiated action to establish a Program Budget Decision (PBD) for the FY 1996 President's budget. As stated in OMB Circular A-131, DoD is required to budget for VE in its annual budget requests. Currently, the Services are funding VE internally with no budget visibility. In addition, OMB is advocating a 20% increase in VE savings from FY 1996 through FY 2000. This will require an increase in investment for this same period. This PBD will establish an OSD supplemental VE investment budget of \$20M annually to invest in increasing VE savings.

Funds will be used in those circumstances where substantial value can accrue the Government and funding is not available within the program to support a contract action or training activity needed to achieve the savings. Approximately 80% of the approved funds will be allocated to implementing VECPs and to providing contractors a share of the

life cycle cost savings. Currently the incentives and payment mechanisms are inadequate to support the pursuit of lifecycle savings by program managers and contractors. These activities present the greatest opportunity to maximize return on investment (ROI).

The OSD VE funds will be used to support five VE specific activities. These activities include:

- Financing selected contractor VECP development and implementation costs where proposals are technically approved but implementation funds are lacking.
- Financing selected in-house VEP development and implementation costs.
- Financing VE studies during design and construction for facility related projects.
- Financing contractors' share of life cycle cost savings resulting from the implementation of VECPs.
- Providing VE training for government personnel and contractors.

DoD Program Offices will submit requests for funds through their representative on the QMB.

After analytical assessment, the QMB will present the requests to the ESG for approval or disapproval. Upon approval, the funds will be disbursed to the appropriate DoD agency for transfer to the program office.

During March 1996, the ESG will conduct a midyear review of Service or Defense Agency obligations to determine the adequacy of the budget profile and adjust the allocation as necessary. This review will also assist DoD agencies in estimating their outyear VE budget requirements.

CONCLUSION

VE success has traditionally been measured on cost savings. It has also inadvertently positively impacted many aspects of quality. Perhaps the focus should be on improving quality with cost savings being a significant but secondary fallout similar to the Japanese approach.

REFERENCES

1. Frank, Gordon A., DOD 4245.8-H, "VE," March 1986, p. 1-7
2. *Ibid*, p. 1-9