6—Value Analysis—Value Engineering

By L. D. Miles,[7] *Visitor*

The basic paper of this symposium so well highlights some of the important concepts and techniques of "value analysis" or "value engineering" that I will document the beginning of this body of knowledge and techniques and express my belief of what is to follow.

History of Development

For generations we have developed and used performance-trained people and performance-oriented systems. The basic objectives were to produce:

. . . a more efficient turbine.
. . . a plane which would fly higher and faster.
. . . electronic gear of greater range.
. . . filter circuits of greater selectivity.
. . . etc.

Each performance-minded person did "as well as he could" costwise—and since no better measurement existed it was judged "good enough." In home appliances—like the simple, successful, hand-operated spin drier—we added complexity to accomplish automatically a wide range of new functions. At the same time, much cost was being added.

Our management became concerned about the growing costs and decided that it wasn't enough to develop *reliable performance* in our products—it must be done at *reasonable cost* or it would be of small benefit to anyone; that it wasn't enough to develop *outstanding performance* in our military products—they must be producible at *reasonable cost* to allow the quantities necessary to accomplish their missions.

A small group of design and manufacturing engineers was assigned the task of developing a program in this direction which would be either accepted or rejected upon its merit. Soon the objective of this group emerged in clear view. It may be described as, "Exactly the same performance at vastly lower cost." Stated another way, "Three ships instead of one, a thousand planes instead of a few hundred, all with the required essential performance."

Accomplishments in developing this value system and proving its feasibility were startling—even in the first studies that were undertaken. In competitive commercial products, usually the total performance (reliability, safety factor, appearance, etc.) could be accomplished with cost savings of between 25 and 40 per cent. In the military type of project, where there wasn't time for real professional-grade value work, the same functions with the same reliability could often be obtained for one third to one fifth of the cost.

As compared with the study of performance, which might be correctly called "performance analysis" (that is, learning more about the performance and the possible alternatives in order to gain improvement), so the study of value (learning more about it in order to improve it) was appropriately named "value analysis" by engineering and manufacturing management.

Then began the process of identifying, developing, and putting together the concepts and techniques needed for effective value work. Just as performance engineering draws a set of techniques from various disciplines so chosen and organized as to be effective in improving performance, so value analysis has drawn from the older disciplines specific concepts, systems of information, and techniques consolidated into plans of action directed sharply toward achieving "the performance needed at much lower cost" (often one half to one tenth in very significant expenditure areas.)

Value Engineering

When the Bureau of Ships in 1954 recognized the great benefits that the value system could offer to the Navy, to national defense, and to the economy, they selected the name "value engineer-

[7] General Electric Company, Schenectady, N. Y.

ing"—which is probably more appropriate than value analysis since it connotes value work being done early enough in the cycle to accomplish economical manufacture the first time.

The results accomplished by adding the concepts, information and techniques of this value program to the technical skills already in place have caused dozens of companies to organize in a variety of ways to bring this value contribution into their products.

Why—Value Engineering

Members of the Society may feel comfortable in recognizing this important newcomer if we list six principal reasons why large amounts of unnecessary, unworking costs exist in essentially all manufactured products.

1 Lack of essential information at the time decisions are made; usually lack of knowledge that the information exists.

2 Lack of the specific idea that would make possible production of the item for vastly lower cost.

3 Decisions based upon honest wrong beliefs which each responsible decision-making person progressively accumulates.

4 Decisions originally forced by temporary circumstances which continue nonfunctioning, unnecessary costs long after the temporary circumstances have ended.

5 Decisions based upon habits—habits of the people or of the area involved; habits built into the drafting and methods systems, into the machines and tooling, and others.

6 Normal attitudes—a predisposition always to react to a set of circumstances in a predetermined manner. These attitudes support habits which cause decision-making patterns to lag far behind technological developments in both the engineering and the manufacturing fields.

One Significant Surprise

It was supposed that the largest obstacle in value work would be limitations in ability to learn and develop sound lower cost engineering and manufacturing alternates. Strangely enough, this was not the case.

By all odds, the largest part of the task of accomplishing functions for much lower cost was found to lie in the realm of thinking habits. Most men who have thought along accepted channels for years, and whose decisions and actions are identified with such channels, are simply unable to evaluate objectively engineering and manufacturing alternatives for accomplishing functions for vastly lower cost when these alternatives might have been available but unknown to them at the time their original decisions were made. Thus the basic problem is one of securing objectively and willingness to change.

Beginning of Training

Next came the necessity to teach this body of knowledge, these specialized techniques, and this understanding of human decision habits to design and manufacturing-engineering people in significant numbers.

This originally required 480 hr of on-the-job supervised work.

It was then streamlined to 160 hr of full-time training on a "tell it - do it" basis.

At present, having benefited by experience and the use of presentation aids, we believe it can be taught in sufficient depth in 60 to 80 hr.

Who Contributes "Value" to the Product

Nothing in the foregoing is intended to indicate that engineering, drafting, manufacturing, planning, and other personnel should not learn and use all of the value techniques and information which they can take in their stride. Certainly this must be done. It would be a significant mistake, however, to believe that these people, in addition to their regular work, can do an adequate job of learning and applying value engineering information and techniques. This vital conclusion has been reached independently through actual trial in scores of cases, involving both original design work and redesign studies. Just as we have learned that, in order to secure acceptable performance of a grade which will complete a formidable adversary, we must assign desired functions to competent performance engineering people, so it is now being demonstrated that to have this performance with the simplicity required for maintenance and the economy required to provide adequate quantities, the special contribution of value engineering also must be included.

Looking at the Future of Value Engineering

Some of us who work in the field of value—who are seeking total essential performance reliability, ease of maintenance, and so on, at lowest over-all cost—believe that value engineering will be developed and used so effectively that we will receive from two to three times the otherwise obtainable armament per dollar. We may well focus on the two essentials:

1 Performance engineering—which needs no comment.

2 Value engineering—reliably achieving the functions developed in performance engineering at much lower costs.

My 10 years of experience cause me to believe that, for efficient military work, these two are separate.

Research and development are basically performance-oriented. Decision patterns are performance-oriented. Organizations are staffed with performance-oriented and "performance-able" people, saturated with performance challenges and performance viewpoints and largely lacking in the essential tools for high-grade value engineering.

On the other hand, value is secured by a different type of thinking, by the use of different tools and different concepts, by the development and application of different techniques.

It is my belief that where hard pressure against the limits of unknowns in performance is required, research and development-oriented work, largely unhampered by "value" restrictions, will most efficiently achieve the essential performance. But very definitely it should not be expected that these performance-oriented designs will be made in any quantity. The clearly defined and obtainable performance objectives will then be made known to value engineers, and they will provide the total essential performance. They will do it with so much less complexity, so much greater use of existing functional devices, and simple and more applicable manufacturing methods, that the cost in production will be from one half to one fifth of the manufacturing cost of the original successful R and D design.

This, I believe, in military type of work, will be the most efficient means in a minimum of time, at the lowest cost, to secure high-performance armament in required quantities.

I further believe that this increased quantity of high-grade armament for the same number of dollars will be provided at better profits to those industries which effectively take the lead in value engineering work.

I have two reasons for this belief:

1 The benefits of good value-engineering work appear directly in dollars, with cause and effect (i.e., investment and pay-off) so promptly and clearly associated that significant sums will be available for division between the industries employing good value engineering and their customer, the government.

2 Several military areas are already developing incentive-type contracts which will recognize in dollars the large contributions made by value-oriented suppliers using value engineering.