

*Pushed by the Pentagon, a startling new technique is revolutionizing conventional cost cutting and stirring up serious controversy in industry.*

# Value Engineering:

**DURING** the hectic Medicare debate in Congress last summer, Majority Leader Mike Mansfield interrupted the tense proceedings to read into the Congressional Record a relatively unpublicized report of enormous significance to the business community. It was a memorandum from Secretary Robert S. McNamara detailing how the Department of Defense had chopped \$750 million off its expenses without reducing the number or performance of military weapons.

This gigantic saving was mainly the result of conventional cost-cutting methods. But one paragraph, buried deep within the report, singled out a little known technique that quietly is revolutionizing conventional cost-cutting methods and traditional approaches to reducing production ex-

penses. That technique is called value engineering, and its recognition on the highest government levels already is making it one of the most hotly discussed topics in American business today.

Basically, what value engineering adds up to is a scientific method of getting the same performance from a product at lower cost. It is a concentrated effort to improve the value of a product—any product—by seeking out and eliminating unnecessary costs wherever they exist in the cycle of product design and manufacture. It follows a step-by-step procedure in scrutinizing every part and operation in the making of a product, examining the function that each part must perform, questioning its usefulness, cost in proportion to usefulness and wheth-

er a company should make or buy the part.

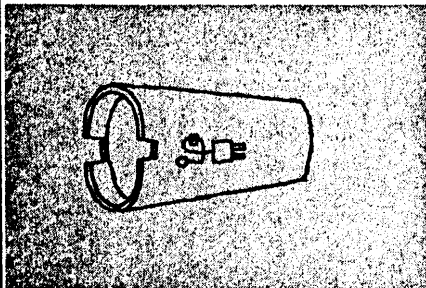
On the surface, value engineering seems to some businessmen such as the president of one West Coast electronics company, "nothing more than a warmed-over hash of a lot of conventional cost-cutting procedures. Running a value engineering program costs more money than it saves, too."

Yet a growing number of the nation's top brass cannot praise it enough. Says the manufacturing vice president of a Midwestern electrical equipment maker: "Value engineering is hard to believe—we started it last year and have saved \$1 million already."

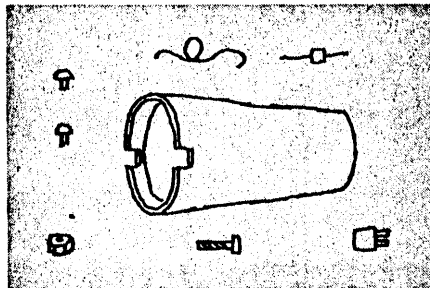
To be sure, there is a great deal of controversy over VE's value, application and how to define it precisely.

## Plucking the Hawk's Tail

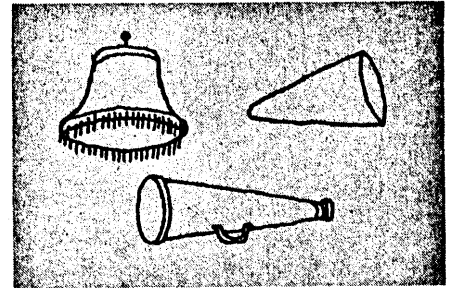
How does value analysis actually work? In this typical value engineering project, Raytheon Co. has redesigned the tailcone of the Army's surface-to-air Hawk missile. The proposed



**EVALUATION** of the existing tailcone emphasized its two main jobs: an aerodynamically sound shape to allow accurate flight and a telemetering antenna for sending flight data to the ground. Three suppliers have been building tailcones made of high temperature plastic and glass cloth with pricetags of \$132 each.



**FUNCTIONS** of every part of the tailcone are analyzed separately to determine exactly why each is necessary and how much the part costs. The wire in the antenna, for example, costs \$1.15 and is needed to transmit a signal. The tailcone shell costs \$119.93 and with four critical jobs is the most important part.



**BRAINSTORMING** sessions where the VE engineers let their imaginations roam wildly were useful to find new ideas. One successful technique was to list products such as lamp shades, megaphones or rejected nosecones that looked like the tailcone. New materials considered ranged from aluminum to balsa wood and canvas.

# Gimmick or Goldmine?

Even value engineers themselves cannot always agree on these matters. But goldmine or gimmick, value engineering seems sure to spread to a large segment of industry, particularly since the Department of Defense is convinced that value engineering programs carried on by its thousands of contractors will lead to a big cost-reduction payoff.

This payoff, according to Secretary McNamara, amounted to \$64 million for the Army and Navy last year. For example, a Polaris missile fuze assembly was chopped from \$50 to \$5, and after value engineering a \$175 turbine wheel cost only \$2.

What, then, are the secrets of accomplishing savings like these? What companies can use value engineering? Where can executives and engineers

learn to apply the techniques of VE to their own products? These are some of the questions that are currently being discussed in many executive suites.

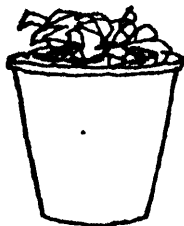
## Born at GE

Value engineering today stems from a technique called value analysis, developed at General Electric during the late 1940s by Larry Miles, GE's present manager of value analysis and the man considered the guiding force behind turning it into its present sophisticated form. In the beginning, Miles and a three-man group of engineers applied value analysis to products purchased by various GE departments. They tried to look at them with a fresh eye. Their objective: to find ways of redesigning them to cut down costs in any way possible.

This job of second-guessing convinced Miles that many engineers often had a very hazy idea of the actual job the parts they were designing or buying had to perform in the final product. In his view, they tended to think principally of the part they were working on, with its role in the salability and profitability of the end product an afterthought. "What was needed," says Miles, "was a systematic way of making people continually aware of a product's function."

But, while worrying about a part's exact job, Miles keeps one eye cocked on the market place. "In value analysis," he insists, "instead of designing for performance first, you determine a suitable cost, then immediately reject any approach that doesn't come within the cost." "This," he adds, "is a re-

changes on this one part alone will save \$100 a missile—\$400,000 on expected 4,000 Hawk orders by NATO.



**COMPARISONS** of production costs were made with other products that either looked like or performed a similar function as the various pieces of the tailcone. Engineers decided, for example, that if the \$119.93 plastic shell was replaced with metal the unit could probably be made in much the same way as a \$5 waste paper basket.



**SELECTION** of the most plausible new materials and manufacturing processes was made. The careful analysis of the product also showed that the antenna, important during the missile's development, was rarely used in tactical models, so it was dropped. Subcontractors were then asked to submit new tailcone cost estimates.



**PROPOSALS** for the new tailcone were submitted to management recently. As in all military projects, making changes involves a lot of red tape but Raytheon engineers think it is worth it because the new spun aluminum tailcone will cost only \$36.50. Of course, there will be production changeover costs of about \$6,350.

versal of the practice of 99% of engineers."

Until a few years ago, Miles' value analysis was usually considered a tool of the purchasing department, where it was used to evaluate products so they could be bought more cheaply. As its techniques were perfected, it was adopted by the engineering departments, and referred to as value engineering. At first, VE was mainly used to cut the cost of existing products. More recently, however, it has become a tool to help design products before they are built.

Today value engineers use a great many techniques that usually result in substantial savings. These include older approaches, such as seeking cheaper raw materials or eliminating unneeded machining operations. Among the newer techniques is the assignment of theoretical dollar values to various standard functions, such as holding two pieces of metal together.

#### Breaking the pattern

Most important, however, is the constant attempt by the value engineer to jar both engineers and management out of their established habits of thinking and make them look at a product in a new way. Sometimes this takes the form of "brainstorming" where engineers with a problem are asked to write down all ideas that pop into their heads, no matter how wild.

Whatever the techniques used, value engineers tend to treat their specialty as a philosophy. Like the Chinese scholars who think of dark and light (*ying* and *yang*) as two sides of the same coin, value engineers see func-

tion and price as the interrelated properties of every product. "Too often in the past," says one executive, "design engineers worried about how to make a part, and management worried about what it cost. Value engineering ties these two responsibilities together."

Many executives, to be sure, may not be interested in the philosophical overtones of value engineering. But all should be vitally concerned with the dollars and cents results that it promises. At present, according to a leading VE authority, only about 45 companies have formal value engineering programs with full-time value engineering specialists. As with most new engineering techniques, the giant manufacturing companies experiment with them first. In this case, military contractors, especially their electronics divisions, have taken to value engineering fastest. And most of these have startling savings to report.

One of the most thoroughgoing value engineering programs is underway at Raytheon Co. About fifteen full-time value engineers are employed in the company's various divisions. Typically, one or two of these specialists will lead a workshop VE training seminar with people working on a particular product. At these workshops, the participants—usually design engineers, manufacturing engineers and procurement people—not only learn the fundamentals of VE but analyze their own current product under the guidance of the instructors.

At a recent session in the military and space division, one student found a way to cut \$400,000 from the cost of the Hawk missile (*see diagram, pages*

*54 and 55*). Another workshop in the microwave and power tube division led to two dozen potential changes in products. One change, involving a small part of a magnetron tube that had been in production for ten years, resulted in a cost reduction of 82%. This will save Raytheon \$10,000 on an average production of 1,500 parts a year.

Frederick S. Sherwin, manager of value engineering services, cannot estimate how much Raytheon saves all together on value engineering. But one division reports cost reductions of more than \$300,000, probably more than the salaries of the company's fifteen value engineers.

Typical of the companies with military contracts that have adopted value engineering in the last year is the GPL Division of General Precision, Inc. Starting with a four-man staff, GPL has already given one third of its 300-man engineering staff some VE training. Actual savings have not yet been chalked up, but several hundred thousand dollars worth of cost-cutting proposals have been made that will affect such varied items as electronic tubes, bearings, packing cases and chassis.

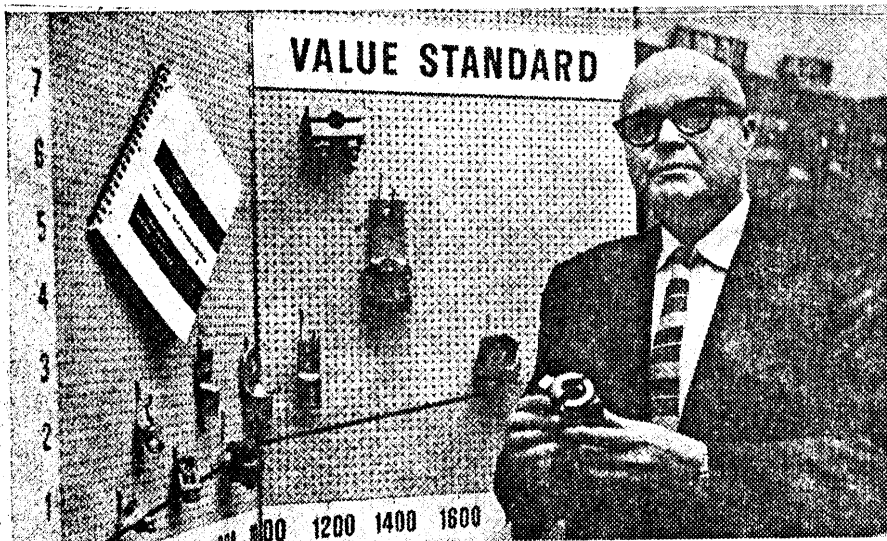
#### The lengthening list

So far the list of companies taking to value engineering reads like a Who's Who of military prime contractors. But more civilian-oriented companies like IBM, A.B. Dick and Carrier Corp. are joining the VE ranks too. The reason, according to Stanley Cartin, Carrier's director of value analysis: "We are becoming more production conscious in this country; markets are becoming saturated, and competition makes every cent count."

Carrier applies VE to everything from heavy custom-built machinery to gas water heaters for homes. One project is a favorite of Cartin's because it illustrates so well the difference between value engineering and other types of cost reduction.

At first a float valve that cost \$49 was redesigned in a cost-reduction program to make it as cheap as possible without reducing its quality. Engineers changed metal alloys, simplified various parts and rearranged the manufacturing process. Finally, they were able to cut the price down to \$35.

A few years later, after the value engineering program was in effect, the value was examined again. This time the engineers got right to the basic



WHEN GE's Larry Miles developed the first value engineering technique, it was used mainly to cut the cost of existing products. Today it is used to help design new ones.

question: "What function do we want the valve to perform?" The obvious answer: to regulate the flow of liquids. After brainstorming a lot of outlandish ideas, one engineer asked if a balloon filled with sawdust might be used to replace a metal ball. Eventually this idea was refined to a hollow polyethylene sphere. The value-engineered float valve now costs only \$6 and is saving Carrier \$35,000 a year.

Cartin estimates that value engineering has often saved 25% of the cost of products affected, two to three times that of conventional cost-reduction results. Looking at it another way, the amount invested in value engineering, Cartin says, is usually returned twelvefold in savings.

With such savings as those reported at Raytheon, Carrier and other companies, how can any executive or engineer be less than enthusiastic about VE? One detractor is even quoted as calling VE "as useful as the wart on a pickle."

The chief roadblock, according to David Farmer, who has organized value engineering seminars for the American Management Association, is that "the majority of top executives assume that each department is already looking for all possible economies." And, he adds, "the chief executive is 'gun shy' of gimmicks and afraid of Parkinson's Law."

### **Some jump too soon**

The reticence of some executives to accept value engineering is based on more than a vague uneasiness about something new. Some companies have jumped into value engineering only to find it did not live up to its promises. One problem is a lack of trained value engineers. Another is that it takes a highly skilled engineering management to make the right decisions on which value engineering proposals are worth putting into effect. "Often," admits President Roy E. Fountain of Value Programs for Industry, a leading consultant in the field, "there was too much ballyhoo before the money was in the till."

Since value engineering is relatively new, there are still bugs in the system.

And more than other engineering specialties, it is still an art rather than a science. In the last year, however, value engineers have formed an organization, the Society of American Value Engineers (SAVE), to solve some of these problems. According to President Anthony Tocco, the group has already signed up about 500 members. The first real order of business for SAVE is to work out in detail just what value engineering is and to come to some agreement about who is qualified to call himself a value engineering specialist.

Despite these serious growing pains, the Department of Defense is determined to push VE fast. Just two years ago, a top level Defense official said that the Department had "reservations, even cynicism" toward VE. This was in spite of the fact that value engineering had been used successfully on some Navy projects as early as 1954. As Secretary McNamara's speech made clear, however, all doubts have now faded.

Some defense contractors knew a change was in the wind almost a year ago when they saw exhibits of VE applications on the conference room wall of Thomas Morris, Assistant Secretary of Defense for Installations and Logistics. And now his staff is taking several specific steps to help spread VE.

The most important is a draft of proposed standard contract provisions that will give companies a dollars-and-cents incentive to use value engineering. A few experimental contracts already provide for a 50-50 split of the gains of VE between the company and the government. The Defense Department also plans to issue a manual stipulating the standards needed to help VE grow. Finally, the Government is producing a film to explain VE to management. One official sums up the Defense attitude this way: "Pretty soon, if a contractor doesn't use value engineering, he had better have a good reason why not."

With this prodding from the Defense Department and the ever increasing competitiveness of all kinds of businesses, a great many companies are expected to turn to value engineering in the next few years. Yet VE authorities urge caution despite their enthusiasm.

"The most important step," warns one consultant, "is that top management gain a clear idea of what VE is. Too often," he adds, "executives have hired a VE engineer and found that he was doing nothing but old-fashioned cost reduction. The trouble was not with value engineering but bad hiring." Another common problem is that executives sometimes set up a VE program and then do not have enough confidence in the proposals made to put them into effect.

Many executives have found that a good way to gain an insight into VE is to attend a short—one- to three-day—seminar run by the American Management Association or various engineering societies. Three consultant companies all staffed by people who learned their VE at General Electric also offer brief orientation sessions throughout the country.

Once management has a clear idea what VE can do, many companies turn to the consultants to train their engineers. The oldest in the business is Value Analysis, Inc., which got started in 1959. Its methods have set the pattern for consultant-run courses.

A typical Value Analysis, Inc. program—about 40 have been given so far—is a \$15,000 package that includes five distinct steps spread over a six-month period. First, top management is exposed to VE at an orientation session at which they learn enough to be able to decide which of their departments could benefit most from VE.

Armed with detailed information about various high cost products, about forty engineers then attend an intensive 36-hour workshop session held by VA, Inc. in the company's own plant. During the training, the engineers work out concrete proposals for cutting costs on real products. "Naturally, not all of these changes will be adopted by management, for various reasons," says Douglas Eagan, manager of VA, Inc.'s product evaluation. "but enough always are adopted to more than pay for the course." In some programs, says VA, Inc., the savings effected as a result of the workshops have hit several hundred thousand dollars.

During the six months after the workshop, the VA, Inc. consultants make three visits to the client to guide

the embryonic value engineering work. A few of the engineers who attended the workshop are also invited to take part in workshops of other noncompeting clients so they can gain advanced training. Finally, VA, Inc. provides a continuing flow of value engineering information.

Similar programs have been run for ten companies by Value Programs for Industry Inc., which has been operating since mid-1961. And Value Engineering Inc. has provided training for a few clients during the last year. For those who prefer the do-it-yourself approach to learning VE, there is a textbook written by GE's Larry Miles—Techniques of Value Analysis and Engineering (McGraw-Hill) and a newsletter, Value Engineering Weekly (\$75 a year).

Most big companies have started their value engineering programs by arranging consultant-run workshops or hiring a value engineer trained at General Electric. In fact, Miles' staff has given value training to about 6,000 GE employees, and about 1,000 have been hired away.

One of the most interesting aspects of such workshops is the change in attitudes among trainees as the sessions progress. Allis Chalmers, for instance, found that when it first took up the technique, many of its trainees had a sort of "chip-on-the-shoulder" approach. Many of them, reports the company, started with the idea that they had been taken away from more important work to sit in on a rehash of cost-reduction lectures. Such ideas, however, soon gave way in successive stages to surprise, enthusiasm and a sense of achievement, as project after project was value engineered with money-saving results.

#### The informal approach

Some companies take a less formal approach than training. Sperry Gyroscope Co., a division of Sperry Rand Corp., simply assigned one of its engineers to bone up on VE and see if it could be profitably applied to Sperry products.

The engineer, David Fram, started reading the available literature about two years ago, attended a few short meetings on value engineering and soon established himself as a one-man

VE department. Since then, he has run small workshop sessions for other Sperry engineers, and established VE programs in the company's seven operating divisions.

Programs like Fram's are not classified as real value engineering by many practitioners. For while he holds to most of the concepts of VE, he does not use many of the newer analytical tools available. "Value engineering," says Fram, "is basically nothing different than old-fashioned cost cutting, only it is better organized. When I go to VE meetings, I get into horrible arguments with other participants."

Fram is not unique in his limited view of VE, and until there are standards of VE training and practice the specialty will suffer from a split personality. "It's not all gravy," says Raytheon's Sherwin; "we still have a lot of sour balls in this thing." But with its faults value engineering clearly represents another step in the general industrial trend toward specialization. "Until recently," argues Larry Miles, "getting appropriate costs has been an everybody-do-it job. That day is gone."

—HERBERT E. KLEIN