SPACE SENTINELS

To detect radiation in space, TRW Space Technology Laboratories designed and built a series of 20-sided satellites for Air Force-ARPA. Launched into orbit around the earth, these icosaedron-shaped satellites travel in pairs approximately 180° apart to form a reliable radiation-detection system.

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The NDS, NASA’s OGO and Pioneer spacecraft, and other space systems are being built at STL in an environment of Cost Reduction and Value Engineering. This TRW philosophy recognizes the cost aspects of organized functional analysis, as well as the improvements which Value Engineering contributes to reliability, maintainability and overall systems effectiveness.

STL has specialized openings in its Value Engineering organization for qualified engineers. To investigate these unusual opportunities, please contact STL Professional Placement, One Space Park, Department VE-F, Redondo Beach, California. TRW is an equal opportunity employer.
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Editorial Notes

Value Engineering's Genesis

This issue of the Journal carries the cover photograph of Larry Miles—in recognition of his contribution to the initiation, growth, and development of the basic principles and techniques of Value Analysis. As Larry completes a long and successful period of full-time active service in this field, he can look back on a series of rewarding experiences and see the continuing development of his initial concepts. We are pleased to recognize his support and assistance in developing the Society of American Value Engineers as its first President. Larry exemplifies outstanding individual dedication and contribution to the Value Engineering profession. The relatively high proportion of such individuals, compared with the Society’s total membership, has been a significant factor in the Society’s growth and in the advancement of the state-of-the-art. If we are to maintain this growth rate and continuing refinement of the profession, more and more capable value engineers must expand their contributions in the form of participation, technical papers, and the acceptance of Chapter responsibilities. A professional society does not stand still—it either grows with interest, or stagnates with apathy. The Society of American Value Engineers appreciates Larry’s contribution to its growth.

Managing Editor’s Milestone

It is with regret that the Journal announces the resignation of its capable Managing Editor, James V. Chinello, effective with the publication of this issue. During the past year, Jim’s experience and support has been a major factor in the Journal’s advancements in format quality, and editorial content. He resigns because of the pressure of other business.

Negotiations are proceeding favorably toward the selection of an established publishing firm to handle publication of the Journal as it continues its growth and development.

— William M. Thompson

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Journal of Value Engineering
Identifying the Creative Man

by HARRISON G. GOUGH
Institute of Personality Assessment and Research
University of California
Berkeley, California

In looking at techniques of measuring creative potential we are, to be sure, interested in the practical and in the extent to which such measures might help in the immediate problem of finding creative people and providing the circumstances in which they can work. But we are also interested in a more complete and searching understanding of the phenomenon of creativity, and in any help towards that understanding that might come from knowledge of valid methods for forecasting creativity. As we look at various methods that appear promising we should keep both of these aims in mind.

The function of measurement is to render distinct what has been vague, to make manageable what has been refractory, and to particularize what has been general and undifferentiated. With respect to human behavior and human skills the specific task of measurement has been to systematize and sharpen the qualitative observations about behavior and its origins which arise from the folk culture, or which are advanced by insightful, but not necessarily quantitative, thinkers.

For example, everyone would admit that intelligence is related to performance in school and other settings where new learning and the application of such learning are emphasized; the dimensionalizing of this concept, the elaboration of a scale of measurement which permits one to state the degree of relationship... the extent to which variations in intelligence lead to determinable variations in achievement... is a technical task. Likewise with the clinical insight that anxiety, usually disruptive and disturbing, may in the context of early psychotherapy constitute a highly favorable prognostic sign; the quantitative issue lying within this qualitative inference concerns the degree of anxiety... how much anxiety is optimal, and is there a minimax condition such that even in the therapeutic context there is some point beyond which anxiety should not be permitted to rise?

I think it is fair to say that measurement of the kind just sketched has been quite successful. There are many dispositions which can be reliably assessed, and there are important life situations in which accurate and useful forecasts of performance can be made. At the same time it is clear that some would doubt these optimistic assertions, and there are other critics... just now particularly active and outspoken... who would question the ethical and philosophical premises underlying any attempt to forecast and perhaps to regulate human behavior.

I would recognize these criticisms, and agree that they must be answered, but with respect to the measurement of creative potential and the identifying of the creative person, I would say that our problem is not doubt but belief. Nothing succeeds like success, and it is precisely these past successes in forecasting performance in school, aptitudes for flight training, likelihood of recovery from psychiatric illness, violation-free survival on parole, etc., which have led to the present difficulty. Knowing that it is important to forecast creative achievement, and knowing that other complex outcomes can be accurately predicted from tests, we want and expect a test of creativity. And we want the test today, in fact this very minute!

Not finding this test, and I certainly do not know where to find it, there is a danger that we will become annoyed and impatient, and conclude that psychologists aren’t doing their jobs properly, or that such a test cannot be built. Let’s admit right off that psychologists and others who are concerned with analyzing and assessing human behavior have lagged behind on this problem. J. P. Guilford in a presidential address to the American Psychological Association a few years ago surveyed 121,000 titles covering 23 years of published psychological research; in all of that vast output only 186, less than 2 of one percent, had anything to do with creativity. More recently, thanks to Guilford and others, this inattention is being corrected but there is still a long way to go. Nevertheless, we are moving ahead and I am confident that in five to ten years there will be at least a few dependable and useful tests of creativity, comparable in efficiency to those which exist today for the assessment of scholastic aptitude and psychiatric stability.

The Nature of Creativity

My remarks may convey the misleading impression that we already know clearly just what creativity is, and that we can agree upon a definition. In general, one finds three points of view concerning the nature of creativity. The first of these asserts that creativity is a disease, a form of pathology, and that the creative man is a sick man. Innumerable examples of madness or near-madness among creative geniuses of the past could be cited in support of this view: the psychotic visions of Blake, the drug addiction of Poe, the alcoholism of F. Scott Fitzgerald, and the sexual disturbances of Renaissance artists such as Michelangelo and Leonardo. The difficulty with this viewpoint...
as a general explanation of creativity is that there are too many instances of apparent good health (physical and psychological) among persons of outstanding creativity, and that in modern studies the degree of psychopathology seems to be negatively correlated with the degree of creativeness. Creativity equals madness is an equation of wide appeal and acceptance, but one which is too frequently contradicted by evidence to stand as a statement of basic truth.

The second view is one which sees the spark of creativity as something alien to the personality in which it resides, as something which has a life and identity of its own. Creativity, in this sense, has little to do with the nature of the person — his health, his disposition, his hopes, fears, ambitions, worries, etc. — and is not to be understood by studying the person in whose work the creativeness has been manifested. This view is not so widespread among people-in-general, but it is a rather popular one among creative workers themselves. Artists and writers often speak of being moved by a creative impulse, and even of being directed by some external force. Amy Lowell (in Poetry and Poets, Boston: Houghton-Mifflin, 1930) said that whereas other poets have mentioned voices speaking to them, and of poetry written almost to dictation, in her own work no voice appeared, but words were vouchsafed to her in a toneless pronunciation. And Mozart in one of his letters speaks of hearing a new musical work in his imagination, and of being able to contemplate it and survey it like a fine picture or a beautiful statue.

This second view is an interesting one, but it too seems contraindicated by the facts. Thoughts and inspirations may seem alien to the creative worker himself, and unconnected with his rational processes, but may still be demonstrated to have their roots in his own nature. Freud’s discovery of unconscious mental processes and of their role in thought and behavior provides the basis for identifying the error in this second view. The dissociated ideas only seem alien and external; in fact, they have a firm deterministic basis in the personality and life background of the individual.

The third view of creativity and the one which I should like to recommend is that which sees creative expression as an integral facet of the personality and as the highest and most distinctive manifestation of it. We are, by this definition, most creative when we are most ourselves, when we are most fully, deeply, and completely expressing our individuality. Creativity is an expression of the individual or the culture at its best, when it is self-actualized, to use Maslow’s concept, when it is most distinctly vital.

The next problem is one of taxonomy, or perspectives on creativity. Before we can measure or assess we need to clarify what aspect or attitude of creativity we are seeking to test. In doing this I believe it is useful to distinguish among four perspectives.

The first of these is the creative product itself. How do we recognize one? What are its characteristics? How can we be sure that a particular product is in fact creative and not just unusual? The rule seems to be that a creative product must satisfy three conditions: it must be infrequent or unusual, that is to say, original; it must be right, that is to say, harmonious and correct; and it must be sustained, that is to say, developed and not merely sketched or outlined. In psychological testing with the Rorschach inkblot test this matter of defining the creative product comes up, on a small scale, many times. If a perception is merely unusual, but does not integrate effectively the amorphous stimuli offered by the blot, or if it is not developed and substantiated in explanation, the scoring convention adopted is that of simple “O” for “original.” If the perception, on the other hand, is unusual but of poor quality, suggesting misperception rather than creative perception, the scoring of the response is “O—.” However, if the perception is infrequent, integrated, and effectively elaborated the scoring of “O+” is given. A creative product, in Rorschach language, is an “O+” response, not a merely unusual or original (“O”) or an atypical but distorted (“O—”) solution to the demands of the problem.

The second condition (appropriateness) is probably the most difficult to apply, and may have to rest on judgment and consensus. Somehow, a creative product must give a sense of reconciliation, of having resolved in an aesthetic and harmonious way the discord and disharmonies present in the original situation. The work of art, for example, for a moment reordered and brings into balance the tensions of form and space, and in so doing, moderates the inner tensions of the observer, giving him a sense of encounter and of fulfillment.

The creative process is our next vantage point. What are the principles of creative thinking? What are the cognitive blocks to such thinking? May one be trained to think more creatively? Psychologists and others have done a vast amount of experimenting on this topic, and it is tempting to spend most of our time today in reviewing some of these findings. However, I am going to forego this course of discussion, and will instead only mention a few illustrations.

One of the consistent findings in studies of creative thinking is that it is flexible. That is, in problem solving there is a tendency to shift and to move, and to avoid perseveration in errors and blind alleys that lead nowhere. This ability to shift is not only manifested in the sense of power, but also in the sense of fluency, the ability to change set and perspective quickly. As an example, I am going to spell a word and I want you to think how it should be pronounced; the question is, “How do you pronounce SO—MET—IME?” Reading these letters makes the task much easier; when the question is only heard, not seen, the usual reaction is to puzzle for a moment before the solution is realized. Flexibility of thinking is required for quick solution of this little problem, because the word as presented orally has the letters grouped in such a way as to impede recognition. In experimental work on creative thinking, tests of flexibility have proved to be good diagnostic indicators.

A second attribute of creative thinking is that the perceptions and associations of the creative worker tend toward the unique and the individual. At the Institute of Personality Assessment and Research in Berkeley we have studied a group of 45 research workers in the physical sciences and engineering. One of the tests they took was a scientific word association test, in which stimulus words like neutron and matrix were presented, the task being to write down the first word association occurring. When the responses of the scientists were analyzed, it was found
that the more creative men, as judged by peer ratings and supervisors' ratings, tended to give responses that were less typical and less common; conversely, the less creative scientists tended to give responses that were more common and typical for the group.

However, the O+ and O− tendencies mentioned earlier appeared here, for the extremely unusual responses were less indicative of creativity in the work of the scientist than unusual responses still within the contextual bounds of the problem. For example, to the word neutron, the responses particle, cyclotron, and nucleus were infrequent and diagnostic of a high degree of creativity, but the words small, head, and baseball, while even less common as associations, were not as predictive of creative work. The most common association, proton, was as one would expect the least indicative of creativity.

A third aspect of the creative process is its concern for form and elegance. This is something that goes beyond correctness and accuracy, and has to do with the aesthetic appeal of the act of thinking. Consider the question, "Is the number 1,000,008 divisible by 9?" There are three ways of solving this problem, all equally fast and all equally accurate, yet differing widely on this aesthetic dimension. The first solution is simply to divide the number 1,000,008 by 9, finding the answer to be 111,112 and giving the correct answer "yes." The second way is to note that the digits in the number sum to nine, and that the original number is therefore divisible by nine. The third way is the most elegant or aesthetic way, and begins with an analysis which says something like this: 'That number is wrong somehow, or it obscures something about the problem; if I expressed it as 999,999 + 9 then the question 'can it be divided by 9?' has a special relevance and meaning.' If the number as offered in the problem is converted by analysis to this new number, 999,999 + 9, then the answer to the question is not just "yes," but something like "yes, of course," or "to be sure." There is an elegance and an appropriateness to the third solution which transcends anything found in the first two. Creative thinking seems always to be characterized by a movement toward solutions of this third type, and by a preference for them.

The third vantage point is the person in whom the creative processes occur, the author of the creative products. What is he like? What are his characteristics? His moods? His dispositions? It is this third perspective of course, which is assumed by our emphasis on diagnostic procedures.

The fourth perspective has to do with the position, the setting in which creative thinking occurs and in which creative products are produced. There is an historical aspect to this perspective, for it is an obvious fact that some societies in the past have been more creative than others, and it also seems apparent that there is a sort of cyclical nature to the swings of creative achievement.

One such upsurge occurred in the 1600s with Newton, Leibnitz, Pascal, Fermat, Moliere and John Locke as examples, and another in the 1800s, as instanced by Darwin, Huxley, Spencer, Macaulay, Galton, Faraday and John Stuart Mill. There is also a sociological aspect to the perspective, having to do with the conditions of work, of expectation, and of the cultural rules which foster or which obstruct the development of creative achievement.

The Creative Person

I wonder if I have given the impression that only certain people, the favored few, can be creative? This idea is widely held, and even finds support among scholars. The sociologist Pitirim Sorokin, for example, has contended that only one person in 500,000 ever reveals creativity clearly above the level of mediocrity. It all depends on what one means by creativity; if creativity is taken as the fullest expression of the personality, as its quintessential flowering so to speak, then the potentiality exists in all persons and each person is capable of some degree of creativeness. The distribution of the potentiality may not follow the curve of normal probability found for intelligence, height, weight, and other human attributes, but even if badly skewed, the distribution cannot be expected to have its mode at zero. The dispute would appear to derive from an all-or-none way of speaking about creativity. If it is granted that there are degrees of creativeness, then it seems likely that some people will show a great deal, some very little, with the majority of persons distributed symmetrically between these extremes. So the disclaimer, "but I'm not creative," is not logical, and hence not acceptable as an excuse for uncreativeness.

I am not speaking entirely in jest, permit me to say, for there may be a justifiable principle of a moral responsibility to be creative, a specific instance of the general admonition to fulfill one's potentialities as best one can. Martin Buber in Hasidism and Modern Man, 1958, wrote, Every single man is a new thing in the world and is called upon to fulfill his particularity in the world. To me it is interesting to witness this change from the early view of creativeness as a mark of evil, of the Devil as it were, to Buber's statement that to be creative is to manifest one's spiritual destiny.

What about the more specific and testable aspects of the creative personality? From studies at the Institute; and elsewhere, I would like to mention five areas.

The creative personality is intuitive and empathic. The autobiographical accounts of persons who have made creative contributions are filled with instances of intuitive thinking, and of a preference for the empathic, intuitive approach to problems. Kekule, the discoverer of the chemical structure of the benzene molecule, attributed his insight to a daydream in which he saw a snake swallow its tail, leading to the conception of the ring of carbon atoms rather than the chain which had been the stumbling block in previous thinking. Otto Loewi, Nobel prize winner for his proof that active chemicals are involved in the action of nerves, credited his insight to a similar experience. He had been working on experiments on the control of a beating frog heart, with puzzling results. Worried over the results, and sleeping fitfully, one night while lying awake he saw an unusual possibility and an experiment which would check it. He jotted down some notes and then returned to sleep. The problem was that on awakening he could not recall his solution, nor could he read his notes. So nothing remained but to recreate the conditions of fitful reverie; and that night, while lying in bed, the experiment once more revealed itself to him. This time he took no chances, but went at once to the labora-
tory and started to work.

What about testing for intuition and empathy? Several personality inventories have scales for variable such as "psychological-mindedness," intuitive preference, and need: intraception. In general, such scales tend to correlate positively with creativity and to distinguish highly creative workers from unselected samples.

The creative personality is perceptually "open," i.e., is not judgmental. Much of our educational training, and many of the pressures in our society, move us in the direction of critical judgment. We prize skepticism, and wish to be tough-minded, hard to fool. When we meet something new or different we search for the flaws, for the tell-tale signs of weakness or subterfuge. When we read a report we ask, "what are the errors, the deficiencies, the limitations of this document?" It is an astonishing thing something new or different we search for the flaws, for the tell-tale signs of weakness or subterfuge. When we read a report we ask, "what are the errors, the deficiencies, the limitations of this document?" It is an astonishing thing to find in the studies of creative workers that this stance of keen critical judgment is not the norm. The emphasis is rather upon perceptual openness, on delight in the new and the different, and on apprehension in its fullest sense. Rollo May's insistence upon the "encounter" as the key to an understanding of creativity is an insistence on just this point: the creative person seems "encounter," seeks to know and to assimilate the totality of what he experiences. William Butler Yeats wrote that "Art bids us touch and taste and hear and see the world . . ."

Horace Walpole's concept of "serendipity," the capacity to discover by accident or sagacity, may also be mentioned under this heading. Many inventions and scientific advances have occurred just because the investigator was perceptually alert, ready to notice the incidental in an experiment and perceptually open to the full range of his experience. C. D. Tuska, Director of Patent Operations for the RCA Laboratories in Princeton, New Jersey, has offered a listing of these "happy accidents" in invention (in Inventors and Inventions, 1957), including Edison's discovery of the principle underlying the phonograph, Goodyear's discovery of the vulcanization process for rubber, and Rontgen's discovery of the X-ray.

In measurement, several personality inventories contain scales for cognitive flexibility, perceptual (as opposed to judgmental) orientation, etc., and these scales do correlate significantly with criteria of creativity. Certain tests of perceptual acuity ... such as the Gottschaldt Figures Test in which one is required to discover simple figures embedded and masked in complex figures ... have also given encouraging findings.

The creative personality is aesthetically sensitive. I have already mentioned the importance of this factor in creative thinking. It seems equally important as a more general disposition of personality. Perhaps the most powerful single test yet discovered as a predictor of creative potential in any field of endeavor is a brief 10-minute measure of aesthetic preference called the Barron-Welsh Art Scale. Higher scores on this test reflect an intrinsic preference for good form and design. One would not be surprised to see such a test correlating with creativity in the arts and perhaps in literature, but we need to note the fact that the test is an equally good predictor of creative potential in the physical sciences and engineering.

The creative personality is emotionally and socially sensitive. The sensitivity envisaged here may be but a special case of the perceptual sensitivity already emphasized. An illustration of the role of this factor may again be taken from a testing device, the Chapin Social Insight Test. This test presents a number of situations in which persons, having different and/or competing needs and desires, are in conflict with one another. The task in the test is to appraise the feelings of the participants, and then to forecast the outcomes of different suggested modes of response. The test ostensibly has nothing to do with scientific work, research productivity, or creativity, and yet in the sample of research scientists its predictive power for creativeness was exceeded only by the art scale mentioned a moment ago.

The creative personality is a complex personality. As C. G. Jung said in his essay on psychology and literature, "Every creative person is a duality or a synthesis of contradictory aptitudes." One of these polarities has to do with the handling of impulse. Freedom from restraint and inhibition is necessary so that the vital and creative impulses of the artist may find expression; yet, too much impulse and too much freedom may overwhelm the personality or may bring him into intolerable states of friction with the persons and society around him. Another polarity is in the achievement domain, where he must adapt sufficiently to the demands of others so as to win his audience without, at the same time, compromising the independence and individuality that will make his work significant.

These disjunctive tendencies, if we may call them that, appear to be necessary concomitants of the creative personality interacting with its environment and making its way toward its full identity. The problems engendered may become serious, leading to the sense of alienation and isolation so often mentioned by creative persons. One thinks first in this connection of artists and writers, but the same phenomenon is observed in the lives of the scientists. Max Planck in his Scientific Autobiography (1949) wrote of his feelings of discouragement and despair over the opposition to his ideas on the part of the leading physicists of his day, coming to the rather pessimistic conclusion that "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it." In an earlier time, the Hungarian Semmelweis (1818-1865), discoverer of the contagious nature of child-bed fever and pioneer of antisepsis in obstetrics, may well have been hastened toward his psychosis and death by his failure to find either acceptance or understanding on the part of his medical colleagues.

The measurement implications under this fifth heading are not for a particular scale or test, but rather for an unusual degree of scatter or variability among scales and tests that covary more closely in other samples. For example, a test I have developed called the California Psychological Inventory contains two scales for achievement motivation, one stressing conformance and the enhancement of form and structure, and the other stressing the derivation of form and the modification of structure. Both scales predict school achievement quite well, and students who are high on one are usually high on the other. But this correspondence is not observed among creative sub-

Continued on page 12
Value Analysis as Applied to a Research and Development Program

by J. W. MOON and J. G. LITTLEJOHN
Ling-Temco-Vought, Michigan Division
Warren, Michigan

The Army's Lance Missile System has been under development in various forms for years under the name of Missile B. The basic theme for LANCE is simplicity, ruggedness, reliability and low cost. To assure accomplishment of these requirements, the Army Materiel Command selected Lance to use special management control systems that were new such as PERT/Cost, incentive contracting and funding of Value Analysis during RDT&E. In fact, the application of Value Analysis to a Research and Development Program was considered unique.

The Lance Missile System prime contract was awarded to LTV in October of 1962 and the letter of intent was signed on 11 January 1963. A new division, Ling-Temco-Vought Michigan was located at the Army Missile Plant in Warren, Michigan. Although utilization of Value Analysis during predesign phase was new to both the customer and LTV, Value Analysis itself was not new to LTV. LTV has successfully employed Value Analysis on other programs for 7 years and has made many strides in application so far as cost reduction and cost avoidance on those particular vehicles, systems, specifications, etc. However, the degree of management judgment applied to LANCE Value Analysis Program was new.

In an attempt to completely present LTVM's methods of applying Value Analysis to the RDT&E phase the V/A Program is divided below into four basic areas:

1) Goals - That is the program goals that were set up in the initial phase of the contract.
2) Organization - The Lance Missile System was pointed toward a Program Management type set up both by the contract and by the customer.
3) Accomplishments - What has been accomplished during the first year in our Value Analysis Program from a standpoint of cost avoidance.
4) Future Potentials - What we feel can be accomplished for the remainder of the RDT&E Program prior to the incorporation of the industrial buy phase (production).

The Value Analysis Program Goals for the Lance Missile System are, in general, to provide a system to meet all target unit cost was established. The Engineering Service Model portion represents the latter part of the Research and Development Program which encompasses the incorporation of the industrial service drawings and production tooling. This unit cost figure represents only production labor, direct material and direct quality control labor, which are recurring costs and gives us a base line from which to measure performance prior to the delivery of those units. Our goal in the production phase is to provide a missile unit cost as desired by the customer and established in the missile requirements.

In the proposal phase of the Value Analysis Program LTV Management wanted to justify the existence of a Value Analysis Program during RDT&E based on expected returns. After an intensive analysis the approach shown below was utilized:

\[
\text{Given: } 1) \text{ Anticipated production cost} = X \\
2) \text{ Expected percent production} = 25 \\
3) \text{ Accepted ratio of savings to cost} = 20 \text{ to 1}
\]

\[
\text{Solution: } 1) \text{ Anticipated cost avoidance} = 0.25(X) = Y \\
2) \text{ Investment justified} = \frac{1}{20}(Y) = Z
\]

\[
\text{Conclusion: The expenditure required for adequate value performance may be expressed by the following formula:}
\]

\[
\text{Expected production} = \frac{0.25 \times (\text{contract cost})}{20}
\]

As pointed out previously, a Program Management Organization was applied to the Lance Missile System. We are indeed fortunate to have 100% Program Management backing and active participation. Figure 1 presents the Value Analysis organization structure.

In setting up the organization, the Lance Value Analysis Program was placed specifically under the Lance Program Director rather than with a functional organization. The Chief of Value Analysis reports directly to the Lance Program Director. At LTV the Chief of Value Analysis has all of the functional organizations represented on his team. This includes Materials, Manufacturing Controls, Manufacturing Engineering, Quality Assurance, Contract Administration, and, of course, the Value Engineering Group. The subcontractors are set up in a similar way in that the Value Analysis coordinators report to the Program Managers. The LTVM Chief of Value Analysis contacts the subcontractors' Value Analysis coordinators directly, thus insuring close and effective teamwork.

The Chief of Value Analysis chairs the governing committee composed of representatives from all departments. The governing committee monitors the overall program and is responsible for the study selection, monitoring implementation, follow-up and review of studies. This com-

Journal of Value Engineering
mittee meets regularly once a week and has special meetings as necessary to perform its function. From the governing body the studies go to special task teams. Each special man and has a member from each of the functioning departments as shown in Figure 2. It should be emphasized that each of the representatives from the functioning departments have been trained in the fundamentals of Value Analysis.

Due to the Research and Development funding of the LANCE Value Analysis Program the following Value Analysis Program firsts were accomplished for Lance.

1) Initial funded V/A Program on a major R&D Contract.
2) Initial R&D contract with unit cost incentive clause.
3) Initial R&D program to use the program definition phase to establish a base for detail hardware concept and cost for V/A Measurement purposes.
4) Initial program to document predicted cost avoidance due to approved changes to hardware prior to the design and production of that hardware.

A significant milestone was achieved during the Lance Precontract Award Program definition phase. This phase afforded LTVM the opportunity to perform a detailed functional hardware concept and cost breakdown. Unit cost incentive for the contract was established as a result of this detailed cost breakdown. It also provided a base for monitoring predicted cost versus target cost. This enabled predicted cost avoidance to be documented due to approved changes to hardware prior to initial design and production of that hardware.

Upon award of the Lance contract, rigid control measures of the detail hardware and cost worth of the function breakdown were established to measure the progress of the program. Unit cost charts were set up and are utilized for reporting and control purposes. The missile unit costs which are a major incentive part of the contract are broken down by missile components. These charts are designed to show contract budget cost, target cost and predicted cost and are updated monthly to be included as a part of the Lance Monthly Progress Report. Other charts contain more detailed hardware and cost breakdown by which progress of the program from a standpoint of unit cost incentive is measured.

On inception of the Lance Value Analysis Program, it was apparent that a sound training program was required. The objective of the training program was to train employees whose decisions affect missile system cost, utilizing studies germane to the current program. There are a number of types of training methods used: short indoctrination period of 2 to 3 hours for all people working on the Lance Program, after hour classes, weekly value analysis meetings, on-the-job training, off premises seminars and workshops, conferences with vendors to help in the training phase of the program and displays and news items. The tools and media used for the training were lectures, movies, slides, guest speakers, pilot studies, workbooks — texts, “Tell — show do” method and reference literature such as techniques of Value Engineering, H-111 Value Engineering handbook, etc. The participants both at LTVM and subcontractors training program consisted of members of all departments. Participants were from top Management, Engineering, Materials, Manufacturing, Quality Assurance and Facilities. A summary of our training to date — including subcontractors — shows 184 trained to date with 36 now being trained. After hours classes are being conducted so that all personnel desiring Value Engineering training may attend. I think it is significant to mention that a cost avoidance of $185,134 for the existing RDT&E Program is due to studies that originated during the training program sessions.

A major benefit of this type of training program is that it encourages persons from all departments to request value studies and orients everyone to be conscious of Value Engineering training may attend. I think it is significant to mention that a cost avoidance of $185,134 for the existing RDT&E Program is due to studies that originated during the training program sessions.

The method of Value Analysis study selection employs the following steps. Function, then target cost and/or worth of function are established for performing each function. The next step is to establish predicted production costs for all hardware utilizing conventional estimating practices by the functioning departments. Those
estimated costs are then compared to the target costs. With this information available, selection of the studies is made from the hardware items most over target or worth. Also, studies are selected by reviewing the contract specification requirements, etc. After approaching the most "high cost—low value" items, the studies are selected by priority downward utilizing the "high cost—low value" methodology.

The LTVM Value Analysis study process system is shown as follows: First, the Value Analysis Group select and initiate the studies. Then the Value Analysis task teams perform the value studies and distribute the value proposals to affected departments for evaluation. After the studies have been evaluated by the departments and fed back to the Value Analysis task team, the study is then put into presentation form. At this point, the Value Analysis Chief or his appointee presents the proposals to Program Management, and/or the customer, if required, who approves or rejects the study. Upon approval of the study by Program Management, the study is implemented by directing affecting departments to incorporate the change. This is done by internal correspondence by a memo from the Program Director or his Chief of Value Analysis. After the directive has been issued it is the responsibility of the Value Analysis task team to expedite and follow through on implementation of the study. After the study has been implemented, it is also the task team's responsibility to document the final results. At LTVM the documentation is completed only when the functional departments have submitted estimates that verify the cost avoidance of "before and after change proposal." The departments submit their estimates through the Value Analysis coordinator to Contract Administration (Accounting). A complete file of each value study is retained in Accounting for records, Army Auditing purposes and for measuring the predicted production cost avoidance and/or saving as the program progresses. We have found that this mode of operation keeps departments aware of all of the estimates being presented, informing all responsible members of the program and affecting real close coordination. This methodology assures that the functional departments are aware of each study and how they were set up to be fabricated, processed, etc. Therefore, when the change comes through they follow the Value Analysis study procedure while incorporating it into hardware.

In the Lance Missile System certain control and reporting methods were established at the outset. The customer, AMICOM, requires the following reports and control medias: Lance Monthly Progress Report, Lance Monthly Progress Review Meeting, which is attended by the customer as well as the contractor and all subcontractors to review the overall status of the Lance System, the Lance Value Analysis Monthly Report which is submitted with all studies, the status of each one of those studies that have been implemented and those that are now being studied, a Quarterly Summary Progress Report and, of course, other control methods between the customer and LTVM is visitation and close contact maintained by telephone. An important LTVM internal control of the Value Analysis Program is weekly meetings that are attended by all Value Analysis Program personnel. All aspects of the Value Analysis Program are discussed at the weekly meeting. Roadblocks, problem areas, etc. are discussed with specific assignments being made at that point so that we have a real smooth running program. Minutes of the weekly meetings are distributed to all functional departments and to all managers which gives everyone a coherent up-to-date picture each week of the progress and of the status of the Value Analysis Program. The Lance Program Director conducts a weekly staff meeting with all LTVM Managers attending that is held to discuss the total Lance Missile System of which Value Analysis is certainly a part of. Summary of the Value Analysis Program is reviewed each week by the Program Director at his meeting as well as the incentive points of target versus predicted costs.

In addition, the Lance Monthly Value Analysis Reports are distributed to all functioning departments in an effort to keep everyone abreast of the Program status. LTVM in working with subcontractors has established a real smooth team operation that we are real proud of. Control methods that are used between LTVM and subcontractors are; the subcontractor Value Program Monthly Status Report which contains the target versus the predicted cost, the complete up-to-date status on all value studies that are in process, a Value Analysis Subcontractor Summary Progress Report which is submitted quarterly from the subcontractor to LTVM and, of course, close contact is maintained by telephone with the subcontractors as well as regular visitations to exchange information, ideas connected with the Lance Value Analysis Program.

What has the Lance Value Analysis Program accomplished to date? For the complete Missile System, LTVM and all of the Lance Missile Systems subcontractors have implemented 65 studies.* In the RDT&E Program phase the estimated cost avoidance for those 65 studies is approximately 2½ million dollars. For the predicted production program, the estimated cost avoidance is approximately 42 million dollars. Of course, we are real proud of the accomplishments to date, but we know we have a long way to go. The detailed breakdown of the studies implemented are shown in Table I below.

I would like to point out an example of a Value Analysis study on the Lance Missile System. Actually, due to the nature of the R&D contract, to date we have had only one value engineering change proposal that had to have customer approval. The description of the missile container change proposal is as follows:

1) Objective — to obtain a low cost simple light weight missile container that satisfies all basic requirements in lieu of conventional bulky casket type high cost container.
2) Concept — the basic objectives were obtained pursuant to extensive Value Analysis application as related to design and material changes.
3) Result — is AMICOM customer approved the change proposal within 3 days of submitted by LTVM.

We have a real close interworking relationship with the customer and all subcontractors and this certainly proved that point. You can see the before and after concept indicated on Figure 3. A cost comparison was made of the original conventional container versus the light weight steel container. The results of this indicate an estimated

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*To be verified by Army Audit Agency.
potential 9 million dollar saving on the anticipated production program for the Lance Missile.

The future of the Lance Value Analysis Program looks very good. Presently, we have 58 studies under consideration, both at LTVM and subcontractors. These 58 studies have an estimated potential cost avoidance for the RDT&E Program of one million two hundred thousand dollars and an estimated potential production cost avoidance of 17 million dollars. The Now-under-consideration, plus the studies that have been implemented, point out that the potential 123 studies contain an estimated cost avoidance of $3,700,000 for the RDT&E Program, or a potential production estimated cost avoidance of 59 million dollars.

These dollar estimated cost avoidances to the United States Government were accomplished prior to and during initial design, before most Value Analysis programs have been started. This early start has paved the way for much greater savings and we are confident that this will enable the LANCE Value Analysis Program to exceed all expectations.

<table>
<thead>
<tr>
<th>NO. OF STUDIES</th>
<th>ESTIMATED COST AVOIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RDT &amp; E</td>
</tr>
<tr>
<td>LTV-MICHIGAN</td>
<td>8</td>
</tr>
<tr>
<td>LTV-MED</td>
<td>18</td>
</tr>
<tr>
<td>DONNER</td>
<td>7</td>
</tr>
<tr>
<td>ROCKETDYNE</td>
<td>19</td>
</tr>
<tr>
<td>BOSCH ARMA</td>
<td>13</td>
</tr>
<tr>
<td>TOTAL</td>
<td>65</td>
</tr>
</tbody>
</table>

Table 1. Value Studies Implemented — Missile System

(Gough) Continued from page 8

jects, who typically score significantly below average on the first scale and above on the second.

On tests of personal adjustment this same variability is observed. Creative subjects usually give more evidence of (or admit more freely to) worries, anxieties, and disturbing ideas but at the same time they indicate greater resourcefulness and strength in coping with such problems.

Conclusion

Testing for creativity is not the same thing as testing for intelligence or school achievement, and in fact tests of aptitude and achievement have proved to be of little or no use in identifying creative talent. There is a pretty obvious implication here for any selection program which seeks to find and to encourage creative potentiality. But although we cannot use these older and well-established tests directly, we can apply methodological skills gained in their construction to the building of tests which can identify creativity. Our hope lies with the future, but, I would add, a realizable future. We can now specify some of the aspects of personality and cognitive functioning which seem particularly relevant to creative work, and certain tests and scales within those categories already possess a limited validity. Complete validity is an impossibility, but we are moving rapidly toward a level of practical utility and accuracy in this significant domain of evaluation.
ON FEBRUARY 26, 1964 Secretary of Defense McNamara signed a DoD directive on Project Definition Phases. It demands that DoD and contractors must know where they’re going before they start. It specifically says that before a PDP can be initiated, “The cost effectiveness of the proposed item must (have been) determined to be favorable in relationship to the cost effectiveness of competing items on a DoD-wide basis.” The cost effectiveness study is one of DoD’s most powerful tools to define a system in terms of function and cost.

In a cost effectiveness study, both cost, on the one hand, and effectiveness (or military worth), on the other hand, are variables. The purpose of the study is to find the point where the ratio of cost to military worth is minimized. Usually two limiting cases are examined. The fixed effectiveness case specifies a military worth and examines on the basis of cost alternate systems that can achieve this worth. The system that achieves the stated military worth at the least total cost is the preferred system. The fixed budget case examines alternate systems of similar cost to determine which has the greatest military worth for the stated mission. Combination studies then may be made in which new systems are configured employing elements from both the fixed budget and the fixed effectiveness cases.

Cost Sensitivity

In any military system, there are some elements that have more effect on the total cost than other elements. For example, in the search and rescue beacon that is used to guide search aircraft to a downed pilot, the range of the beacon is a parameter of great cost sensitivity. If the range of the beacon is one mile, many search aircraft are required to cover the ocean area in which the pilot was lost so that he can be located and rescued within a specified time, say six hours. If the range of the beacon is increased, less search aircraft are required, and the cost of the total rescue operation is lowered tremendously by a small increase in cost of the search and rescue beacon.

Meaning of Cost Effectiveness to Value Engineers

During a system feasibility study, the major trade-offs are made that determine the system configuration, and the function of each subsystem is determined. All of these results are assessed by cost effectiveness analysis and the final configuration adjusted. After the system as a whole is defined, each subsystem and each of its component parts has a clearly defined function and, correspondingly, each represents an apportionment of some part of the total military worth of the system. Or, to state it another way, the portion of the military worth (or the value) of each subsystem becomes relatively fixed, within rather narrow limits, and manipulation of this worth as a variable is no longer fruitful. However, manipulation of the other variable, cost, is most fruitful.

Now design and development engineering becomes paramount as each subsystem is implemented as a hardware design. This preliminary hardware design then becomes the baseline system that is amenable to improvement and refinement by many engineering specialties, among them being value engineering. In improving the ratio of value to cost, value engineers will usually find they are confined to the reduction of cost since value, in the sense of military worth, has essentially been fixed.

We value engineers can determine where efforts can be most fruitfully employed by going back to the cost effectiveness studies and applying our efforts to the portion of the design that the economists have shown to be most sensitive to cost. And we can hammer hard here, using our traditional tools. Since our efforts, even in the ideal case, are necessarily limited (that is, we cannot expend large amounts of effort on all facets of the design), we can avoid spending any time on the parts of the system that are relatively cost insensitive.

One of the many ways of looking at a cost effectiveness study is the plot of cost versus effectiveness for acquisition cost and for operational cost.

For example, as shown in Figure 1, a plot for a typical system may show that the acquisition cost increases as
effectiveness increases, while the operational cost of the system decreases with increased effectiveness. For the particular system plotted the portion of the curve of total cost between points A and B represents the optimum cost/effectiveness ratio. It is within these bounds that a system is defined during its feasibility study.

Cost Uncertainty

Figure 2 illustrates the uncertainty of knowledge of cost in relation to time phase in developing a system. To balance the cost effectiveness scale accurately, each element of cost that goes into the total cost to meet the objective was estimated as accurately as possible. The designers and value engineers have full freedom to deviate from the ideas conceived at the systems design and the cost effectiveness study phase, because only the function and an estimated cost have been established, not a particular way to achieve the function. The cost estimates have inherent uncertainty.

![Figure 2](https://example.com/f2.png)

Cost Effectiveness Analogy

Returning to the over-simplified example, shown in Figure 3, the development costs must bear some relationship to the production costs; the relationship is generally a function of the number of units to be produced. These two costs together, the total product cost, are related to the operational costs of the system, in general, by the operational life of the equipment. All three costs make up the total system lifetime cost.

To evaluate the alternate ways to meet the objective, engineers total the cost buckets and evaluate the effect of differences in dollars on military worth or value. Value engineers have urged that value engineering attention be moved upstream closer to where cost is created. Cost effectiveness analysis is all the way upstream where it can function in the most fertile fields of cost prevention. How can we use a cost effectiveness analysis? A cost effectiveness analysis gives us an assessment in dollars of each task and function in the system, and the system includes all the buckets that make up development, investment, and operation. This then is what is important to the value engineers. The cost effectiveness analysis provides a function related to cost for each system element. This relationship is the preliminary value standard we can use as a base to measure from. We can now devote our main efforts to the factors shown to be most sensitive to total cost, using the pre-established standards, and proceed to make meaningful and measurable trade-offs based on total cost.

To paraphrase Peter Drucker, the cost sensitivity study enables us to dispel that confusion between efficiency and effectiveness that stands between doing things right and doing the right thing. There is nothing more worthless than doing with great efficiency the value engineering job that did not need to be done at all. It is the cost sensitivity part of the study that tells us where to look.

Phasing of Value Improvement Effort

Figure 4 shows the value improvement effort that should be carried out during different phases of a program in order to meet or exceed the established cost objectives. We must bear in mind that the primary personnel shown associated with the task are not the only people involved. All engineering specialties are involved. The cost analysis personnel in the early phases are basically systems engineers and economists who work with the military data and system level data. In the design and production phases, cost analysis depends heavily on value engineers and production cost analysts.

Examination of the chart shows that the cost effectiveness analysis is conducted during the early phases of a program and value engineering during the later phases. In the system design and design trade-off efforts, either or both cost effectiveness and value engineering people may be active. At this stage, they work together. Where one activity stops and the other starts is not well defined, it depends upon the circumstances. However, the objective is the same — get the required functions for the least bucks. At this time, the engineer should examine the preliminary product cost goals and scrutinize the design to see where value engineering effort and design trade-offs can do the most good. Again within reasonable limits, one can make budgetary estimates of product cost and operational cost from past data and experience.
It is apparent that as the project moves downstream and the definition of the hardware is developed, we can pinpoint our costs with greater accuracy. We can refine our decisions. To get this refinement and thereby reduce cost, DoD offers us cash incentives. DoD requests that value engineering clauses be put into procurement contracts. The VECP (Value Engineering Change Proposal) was developed as a medium to implement these changes for refinement. At this stage Value Engineering, an engineering function, Value Analysis, the purchasing effort, and Methods Improvement, the manufacturing support, work as a task team to generate VECP’s.

Summary
In summary, design and value engineers must become thoroughly familiar with the cost effectiveness study and all data collected or derived in making this study so that they may:

1) Locate cost-sensitive areas to be used to advantage in the system and hardware design stages.
2) Be able to define the base line for establishing savings, and thereby evaluate and justify Value Engineering Change Proposals.
3) Know the base line on which to base savings derived from class 2 changes. (Class 2 changes can be made without contract change.)

Through the proper use of the cost effectiveness studies that are now a required part of every major system definition, value engineers are now being provided with the information that was often lacking in the past.

<table>
<thead>
<tr>
<th>Contract Phase</th>
<th>Contract Phase Approach</th>
<th>Study Area</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study of General Operational Requirement</td>
<td>Broad</td>
<td>Performance comparison of various types of existing or projected systems.</td>
<td>X</td>
</tr>
<tr>
<td>Feasibility</td>
<td>System Operational Requirement</td>
<td>Subsystem and equipment performance tradeoffs to minimize cost while meeting specification requirements.</td>
<td>X</td>
</tr>
<tr>
<td>Project Definition Phase</td>
<td>System and Subsystem</td>
<td>Subsystem and equipment performance tradeoffs to further reduce cost with system specification modifications within mission and performance envelopes.</td>
<td>X</td>
</tr>
<tr>
<td>Advanced Development Program</td>
<td>System and Subsystem</td>
<td>Subsystem and equipment performance tradeoffs to reduce costs within subsystem and equipment specification modifications. Design, test and fabrication cost versus operational cost tradeoffs.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>System and Subsystem</td>
<td>Subsystem and equipment performance tradeoffs to reduce cost within subsystem and equipment specification modifications. Design, test and fabrication cost versus operational cost tradeoffs.</td>
<td>X</td>
</tr>
<tr>
<td>Development, Engineering Model, and Prototypes</td>
<td>Subsystem and Equipment</td>
<td>ECN, ECP, VECP, and Class II Change</td>
<td>Subsystem and equipment performance tradeoffs to reduce cost within system and equipment specification modifications. Design, test and fabrication cost versus operational cost tradeoffs.</td>
</tr>
<tr>
<td>Production</td>
<td>Equipment</td>
<td>Equipment design to minimize production cost.</td>
<td>X</td>
</tr>
</tbody>
</table>

Figure 4. Time-Phased Value Improvement Effort

CHANGE OF ADDRESS

This Journal and the Society have experienced considerable difficulty in maintaining correct mailing lists. The distribution of Journal Vol. 2, No. 3 in May was a case in point. Some 300 copies of this issue were returned to the Journal office undelivered, for which the Journal was required to pay a return postage fee.

Please notify the Journal and your Society chapter immediately of any change of address!
Tocco Receives Associate Fellowship in AIAA

Anthony R. Tocco, Manager of Value Engineering at TRW Space Technology Laboratories, and immediate past president of the Society of American Value Engineers, was elected an Associate Fellow of the American Institute of Aeronautics and Astronautics by the Officers and Directors of that Society in April of this year. Mr. Tocco's election reflects his original work in the field of rocketry and related technical disciplines and his contributions to the arts, sciences and technology of aeronautics and astronautics. He was a Charter member of the Southern California Section of the American Rocket Society in 1945, was founder and first President of the Arizona Section in 1953 and became a Senior Member of AIAA when ARS and the Institute of Aerospace Sciences merged in 1963. In 1952, he served as a member of the ARS National Space Flight Committee.

Tocco is presently serving the Society of American Value Engineers as a Special Consultant to President Frederick S. Sherwin, and in this capacity is currently assisting the National Aeronautics and Space Administration in the development of their value engineering program.

Northeast Region Chapter Chairmen Plan 1965 National Meeting

Chapter Chairmen in the Northeast Region held a conference on June 11 in Waltham, Massachusetts, to exchange ideas and to coordinate activities in that area. The meeting was Chairmanned by Bob Gillespie, Sylvania Electronic Systems, who is Director of the Northeast Region. Participants included: National President, Fred Sherwin; Jim Allis, Chairman, Niagara Frontier Chapter; Roy Armstrong, Chairman, Mid-New York Chapter; Henry Halverson, Chairman, Connecticut Chapter; Don Madden, Chairman, Paul Revere Chapter; Terence Murphy, Metropolitan New York Chapter; R. Keller, Connecticut Chapter; J. Butler, Paul Revere Chapter.

Included in the agenda was advanced planning for the 1965 National Meeting scheduled to be hosted by the Paul Revere Chapter and preliminary planning for a Northeast Region Colloquium in Hartford, scheduled for the fall.

Bagdad-by-the-Bay Chosen as SAVE Western Colloquium Locale

"Value Engineering—the Golden Gate to Profit Improvement" is the theme of the third annual Western Colloquium of the Society of American Value Engineers scheduled for October 23 in San Francisco, California. This important regional conference will be held at the Marine Memorial Club at 609 Sutter Street and will include both technical sessions and exhibits. The keynote speaker will be the Society's President, Frederick S. Sherwin, Director of Value Engineering for Raytheon. This year's colloquium will not only be supported by chapters in the Southwestern Region, which sponsored the 1963 Colloquium in Los Angeles, but will also be joined by the Portland and Seattle Chapters representing the Northwest Region. The Colloquium's Co-Chairman, Alfred H. Petersen, has advised the Journal that papers may still be submitted for consideration. The proper contacts are:
Discussing ways and means of delivering the best quality for the lowest cost at the Value Engineering Symposium of AIIE Annual Meet in Philadelphia were, l. to r.: Fred S. Sheirwin, Corp. Director of VE, Raytheon, and National President of SAVE; Hon. George E. Fouch, Deputy Assistant Secretary of Defense; Frank J. Johnson, VA-E Department Manager at Gelac, Chairman of the symposium; George J. Parker, Div. of Adm., Martin-Orlando; A. J. Wojtowicz, Chief Ind. Eng., E-P Div., Bendix, and Ervin Leshner, Administrator, Defense Value Improvement, RCA.

Lou LaForge, Co-Chairman Technical Sessions, Value Engineering, Inc., 1461 Ascension Drive, San Mateo, California. Phone: AC 415 345-6396, and Stu C. Corns, Co-Chairman Technical Sessions, Value Engineering Administration, IBM, 2530 La Mirada Drive, San Jose, California. Phone: AC 408 227-7100.

Delaware Chapter to Participate in V. E. Seminar

An organization meeting of twenty Officers, members of the Board of Directors, Committee Chairmen and members was held July 9, at Shoyers in Philadelphia. Plans were made for the next year and will be announced soon, according to Art Inman Publicity Chairman.

The Delaware Chapter is to participate in a Small Business Administration — SAVE — One Day VE Seminar to be held in Philadelphia in the middle of October. Project leader for this operation is Al Prant, who will be assisted by all affected committees. This is a big undertaking for the Chapter and will require the support of all members. More details will be furnished as the planning develops.

Atlanta SAVE Chapter Formed

Inaugural meeting of the Atlanta Chapter of the Society of American Value Engineers was held at the Holiday Inn, N.W. (Atlanta), on June 25. The meeting was held to organize the Atlanta Chapter, to elect temporary officers, and to brief the Charter and prospective members of the objectives and purpose of the Society.

Initial membership of over 20 engineers from Lockheed enabled Temporary Chairman Frank J. Johnson, Value Analysis manager at Lockheed-Georgia, to apply for the Atlanta Chapter charter, which will be presented to the Atlanta Chapter at the charter presentation meeting on Monday evening, August 10 in Atlanta by the S.A.V.E. National President Fred Sherwin, Corporate Director of Value Engineering, Raytheon Company.

The National Board of Directors of the Society will meet in Atlanta on Monday, August 10, coincident with the Value Engineering Symposium sponsored by the Eastern Contract Management Region of the Air Force on Tuesday, August 11.

Members of the National Board will take an active part in this Symposium and it is anticipated that the Charter Presentation Meeting will be well attended by National Board and Air Force members.

Book Reviews


The concepts, data, and findings of the earlier book have been extended, refined, and substantially added to in the present volume by Professor Scherer. In particular, he has analyzed and appraised reports, information, and data stemming from the drive by the Department of Defense for incentive type contracts and the more recent move by the Office of the Secretary of Defense to establish a system of contractor performance evaluation.

Incentive systems operate by rewarding desirable performance and penalizing undesirable performance. Two broad classes of incentives, differing mainly in the form of the reward, are analyzed in this volume. Competitive incentives, considered in Chapters 2 through 5, involve the correlation of sales with contractor performance. Contractual incentives, examined in Chapters 6 through 10, involve the correlation of contract profits with contractor performance. In Chapter 11 the author assesses the impact of these incentives on quality maximization, development time control, and cost reduction. The last chapter discusses the trend toward increasingly detailed direct government control and supervision of contractor operations.

The study is directed toward a dual audience. On the one hand, it deals with problems of interest to those responsible for formulating and executing procurement policies within government and for operating under those

Continued on page 30
Engineers' Corner

by Alfred H. Petersen
Manager, Value & Production Engineering
Lockheed Missile & Space Company

This corner is for Value Engineers who want to talk with one another about their favorite subject and exchange value engineering ideas and information. If you have information valuable to you and wish to share it, send glossy photos, black on white line drawings and typed double-spaced copy along with written permission to publish to: The Engineer's Corner, c/o A. H. Petersen, D/81-22 Bldg. 153, Lockheed Missiles & Space Co., Sunnyvale, Calif.

Graphs are reprinted from the November-December 1963 issue of Ordnance by permission of the editors.

quality standards vs. cost

depth-cost study of drilled holes

journal of value engineering
Value Task Force for Components
—Case History

by R. L. CARNINE
Guidance & Controls Division
Hughes Aircraft Company
Culver City, California

This report describes the organization for and performance of a value engineering program directed to the evaluation, selection and procurement of all discrete components planned for usage in a major fire control system. Strong emphasis is placed on the methodology employed. Basic principles can be applied within the framework of any company to any project at almost any stage evolution.

The component value engineering program was initiated concurrent with engineering release to manufacturing. Objectives were twofold: (1) study, evaluate, select and procure all discrete components for production systems and, (2) develop procedural methods oriented for rapid economical implementation of approved recommendations.

Procurement solicitations had been made previously, thus providing a firm fixed cost base for calculation of savings.

THE PROBLEM
The problem of selecting and procuring components for the project involved optimizing many factors: (1) contractual obligations, (2) performance objectives, (3) state of the art, (4) state of development, (5) pressure imposed by schedule, (6) design, (7) reliability, (8) quality, (9) maintainability and manufacturability criteria, (10) organizational and procedural factors and (11) cost.

Major constraints were those imposed by state of development and schedule. Design release was scheduled prior to scheduled completion of the VE program. Manufacturing schedule prohibited changes requiring major redesign. This led to adoption of a general ground rule restricting changes to direct substitution not affecting form, fit or function.

The component VE program involved a critical examination of semiconductors, capacitors, resistors, relays, connectors, rotary components, switches and vacuum tubes. This included:
1) Establish an organization for collection and analysis of data and for implementing recommendations.
2) Updating composite lists to reflect total component usage.
3) Review component specifications. Generate recommendations for changes in or waivers to these documents to reduce manufacturing costs.
4) Reduce the total number of component types.
5) Determine availability of usable components at reduced prices due to high inventory, substitution with alternative devices, etc.
6) Eliminate sole source articles.
7) Conduct bidders conferences to provide guidelines for suppliers.
8) Evaluate supplier responses. Develop trade-off analyses.
9) Generate and issue documentation supporting selections.
10) Audit and report savings to Project Management.

ORGANIZATION OF THE VALUE TASK FORCE TEAM
The significant ground rule employed in establishing the Component VE Organization was "Utilize fully existing company policies, procedures, functional area responsibilities and capabilities of specialists, including suppliers."

Responsibility and authority was delegated by Project Management to the Chairman of a Value Task Force Team. This team consisted of senior representatives from affected areas as follows:
1) Project Management
2) Circuit and Product Design (Responsibility determined on basis of design cognizance.)
3) Reliability
4) Quality
5) Component and Materials Laboratory (Standards Group)
6) Manufacturing
   a) Manufacturing Project Engineering
   b) Manufacturing Supplier Quality
   c) Material Control
   d) Procurement
7) Value Engineering, Team Chairman

Members assigned by their managements were authorized to participate in team operations and act in behalf of their areas. Team chairmanship was vested in Value Engineering, an area having neither design cognizance nor manufacturing responsibility, thereby assuring objectivity in operations management. See Figure 1 — Organization.

OPERATIONS
The program consisted of several independent but related scopes of work, some accomplished concurrently. Basic approach and actions taken are delineated below in general, but not necessarily explicit time sequence.

Contractual Aspects — Components
A detailed investigation of contractual requirements was made. Interpretation led to development of criteria and methods permitting procurement of components, having a satisfactory level of product assurance.

Specifications Review
1) Product Assurance Tests
The original list of components tabulated from drawings...
and Bills of Material included a “duke’s mixture” of devices ranging from obsolete types to articles designed for operation in outer space environments. Corresponding test requirements ranged from none at all to complex, time-consuming and expensive tests performed in simulated extra-terrestrial environments.

Had procurement been made on this basis, some articles would have received no tests; others would have received tests under conditions never approached in end use. Alternatively, the rewriting of even a minority of specifications would prove time-consuming and costly. A third alternative was selected. Product assurance tests were specified by suppliers utilizing existing in-house programs.

2) Coordination of Design Requirements

Concurrent with obtaining product assurance data from suppliers, design engineers were asked to furnish requirement data by device application. Consolidations were proposed from tradeoff criteria developed by considering factors involving (1) standardization, (2) device costs, (3) reliability, (4) quality, (5) availability, (6) sole source, and (7) specification requirements unimportant to the project but which increased costs.

Proposed changes were grouped by unit and negotiated with designers during evaluation. New composite lists thus compiled were used to solicit responses from suppliers. These lists represented consolidations of JETEC numbers and 900,000/(Hughes) specifications with requirement data identified and quantities extended.

Inspection of the lists indicated ways that specific device types could reasonably be used to satisfy a multiplicity of requirements. Rather than attempt to out-guess the current market, however, it appeared more desirable to permit the suppliers to make specific consolidation proposals. Given suppliers technical responses, final evaluation established component lists which presented the most reasonable relationship between performance, product assurance and cost.

Supplier Participation

Participating suppliers had existing in-house product assurance programs, some more elaborate than others. These were their means of identifying and controlling quality and reliability levels and electrical parameter distributions.
Analysis of supplier-furnished data indicated that tight control was customarily maintained on manufacturing lines in their facilities. Supplier programs were tailored to meet requirements of military specifications such as MIL-S-19500, MIL-Q-9855, etc. Some programs exceeded specification requirements by an order of magnitude in certain areas and all devices were subjected to test evaluations whether the end products were categorized as commercial or military. The in-house programs therefore became a part of the basic device cost.

Minor differences in procedures between suppliers made it impractical to legislate specific test programs. To have done this would have caused tailoring of such programs to capabilities of specific suppliers and increased costs for other suppliers who would have been required to modify their normal in-house procedure.

Based on the foregoing, suppliers were required to furnish detailed descriptions of their in-house programs and a specific commitment relating their use (including accept/reject criteria) to all devices they proposed to furnish. This commitment was a binding part of their response to the RFQ. Formal certification of compliance was required with each shipment of components.

**Bidders Conferences**

A formal bidders conference was held to present to semiconductor suppliers data packages and instructions pertaining to their responses. A second conference was held after engineering evaluation of the responses to accumulate final costs on the updated semiconductor list.

A third bidders conference was held covering all other generic component types. As with semiconductors, suppliers quoted on devices for which they had manufacturing capability, whether or not their company was a qualified source on a particular specification. Qualification of vendors to furnish devices to a particular specification was determined by evaluation of their proposals, plus other intelligence already available concerning their capabilities (previous surveys, QPL and MIL qualifications, etc.)

**Evaluation**

Evaluation was accomplished through combined efforts of all participating members of the team. Two copies of responses were furnished by suppliers. One copy went to the procurement activity, the other to the Value Team Chairman. The procurement activity determined supplier delivery capability.

Value Engineering prepared proposed component selection lists based on costs, consolidations and substitutions. This selection list included: (1) device specification appearing on drawings, (2) device specification proposed for procurement and (3) a list of suppliers arranged in ascending order of cost. Copies of this list were furnished to the Components and Materials Laboratory, Reliability and Quality for approval of sources.

Where substitutions were proposed, approval was obtained from appropriate circuit and product designers. The entire proposal was thus approved by assigned representatives from all affected areas.

**Procurement**

1) **Direction to Procurement**

Purchase of articles became a matter of simple direction to procurement. The composite recommendation was approved by Project Management who then directed the procurement activity to purchase the articles in quantities and from sources shown on the Device/Vendor Selection List.

2) **Specification Document Control**

To control the procurement, incoming tests and eventual use of the devices, some positive form of control documentation was required. A document was developed by the team called a “specification waiver.” This specification waiver listed (1) the devices as called out on the drawing, (2) the nomenclature of the device to be procured, (3) the specification document containing the test criteria, (4) special tests required, (5) a requirement for utilization of the suppliers in-house testing program, a requirement for formal Certification of Compliance and, (6) listing of qualified suppliers.

The procedure using the specification waiver document resulted in substantial savings both in time and dollars since it utilized essential portions of existing specifications. In addition, since “substitution by direct replacement” was used generally, no drawing changes were required. Procurement was considered a “one-shot” buy and future replacements could be made using either devices as procured or as called out on the drawings.

**RESULTS**

Initially, 235 semiconductor line items called out on drawings and Bills of Material were reduced to 199 by combining items having obvious and undisputable identity. The remaining 199 line items were scrutinized by the Team and reduced to 130 line items. A breakdown of reasons for combining the 69 deleted items is as follows:

1) **Errors** — 4%
2) **Reliability/Quality** — 51%
3) **Consolidation** — 28%
4) **Substitution** — 5%
5) **Engineering Change** — 12%

Audited, documented savings for semiconductors were $715,711, representing savings of 60% of original cost based on the procurement solicitation made prior to initiation of the VE program.

Savings in rotary components amounted to $317,909, 38% of original cost on the same basis. Documentation of savings accruing to the other generic types of components has not been completed.

Savings documented thus far reflect only the direct savings accruing to procurement. Indirect savings will substantially increase overall total. Expenditure for the VE program was $43,000, yielding a return ratio that is apparently fantastic, but on the other hand may be considered typical of what can be expected when value engineering techniques are applied on a broad scale to specific programs.

"It takes about seven years to convert the average man to the acceptance of a solved problem."

THOS. A. EDISON
Establishing the Need for an Effective Value Engineering Program

by ROBERT L. BIDWELL
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The need for value engineering in any company, large or small, is everywhere present. It is as real and urgent in the competitive system as the need for profits. But industry's response to this need seems to be uncertain. Management is not completely sold on this "need" for value engineering.

Perhaps we should analyze this situation and objectively find out why! In my opinion this condition develops from a failure to communicate an understanding of an idea. Professor Frank Goodwin, an outstanding teacher of salesmanship at the University of Florida, says selling or communicating an idea is so simple that it is often turned into a laborious, complex job.

The basic approach that Professor Goodwin outlines for people studying salesmanship can also apply when establishing a need for an effective value engineering program. He outlines his approach as thus: 1) determine what a person really wants, 2) promise to give him what he wants or help him get it, and 3) supply enough information so that he will have confidence in your ability to perform what you promise.

The attitude today toward value engineering ranges from full acceptance to one that is completely negative... even hostile. Some programs give mere lip service acceptance. What are the reasons for this? For one thing, we fail to effectively communicate where, why and how value engineering will be beneficial. As a result, there is a reluctance in some companies to institute a value program. Some fear that the organizational changes involved might "rock the boat." But is this true? Does institution of a VE program disrupt an organization? According to a recent survey, many companies have found ready acceptance on the part of their employees after a carefully planned, company-wide educational program has been conducted.

By tailoring the educational-promotional material to your specific audience... by translating the program into terms of what it means to each individual employee and his welfare... by motivating him to want to participate, support is generally enthusiastic. All levels including production workers are motivated to submit suggestions to value engineers for consideration.

Another objection you will face comes from administrators who argue that every good engineer is, in fact a practicing value engineer. These administrators insist that their engineers know the importance of production costs and keep them in mind when designing. They say any man who neglected this important function would be fired. Therefore, these administrators maintain that they neither need nor want value engineers looking over the shoulders or acting as monitors of their designers. These viewpoints deserve our serious consideration. If these assertions are a fact, we should fold our tents and disappear into the night. However, unless these design engineers can produce designs that cannot be successfully value engineered, there is a need... yes, a necessity for an active value engineering program. A sampling of across the country experience indicates that the achievement of such a goal is the rare exception.

It is generally recognized that 25 percent reduction is a reasonable goal for a first-round value engineering attack on a commercial item and 50 percent is a legitimate target on military hardware. Now this is not to imply that engineers have done a bad job. However, rapid and changing advances in technologies make it impossible for any one individual to keep up with all parameters of the state-of-the-art affecting a design of any complexity. Also, pressures and time limitations often prevent the designer or engineer from taking a "second look" for the way to perform the function better... more economical.

Value Engineering, to be most effective, must be instituted at the design concept stage and continue on through development and production. The question is: How do you convince management that application of value engineering will pay off more fruitfully during these earliest development and design stages? You are attempting to sell something that is extremely difficult to measure when compared to existing hardware. However, a strong case for establishing a VE program can be made if you have proven your point on production hardware. It is obvious to any sophisticated management that changes in engineering documentation, tooling and additional testing are very costly and can be avoided if one value engineers the item before design freeze and tool manufacturing. We all know that is is nearly impossible to save money "in the traditional sense" during this stage, yet by the same token we know that the cost reduction impact from any value engineering action during this stage has its greatest effect.

Five months ago, you will recall when President Johnson took office as chief executive, one of his first measures was to cut the defense budget and tighten the defense industry's belt. He pledged his administration to "give a dollar's value for a dollar spent." Secretary McNamara has been exerting pressure to get away from cost plus fixed fee contracts. This is fast becoming a new approach which Defense Industries must meet. When you can no longer overrun your estimates without fear of losing contracts for your company, controlling costs suddenly be-
comes extremely important. Value engineering is one technique that can be confidently and reliably used to make a major contribution to the accomplishment of this goal.

No industry can afford the luxury of design groups that cannot satisfactorily design against a “cost to manufacture” target along with the usual performance requirements. Some companies are developing a Pert/Cost system. Some are developing a cost target system which they feel responds more rapidly than Pert/Cost can and some are going blithely along the old CPFF philosophy. Competition will weed out the companies that fail to control their costs and yes, even reduce their costs!

It must be obvious to you that it should not be necessary to establish a need for VE. The need exists for the use of the best tool available to survive in the economic jungle in which we all exist. If we follow Professor Goodwin’s sales approach, we can assume that every management really wants an effective value engineering program.

The second step in this approach is to promise to give management what it wants or show him how to get it. Our next move is to promise management a productive VE program...one that will produce lower costs to operate.

Once the promise is made, the third step in the process must take place. Enough information must be supplied to management to convince them that you have the ability to perform what you promised. The secret in this process is to provide just the right amount of information. Please do not overwhelm the recipient!

Let me suggest several approaches for the information presentation. Take a look at one of your production items and develop a VE study case. This is the easiest place to prove the feasibility of employing value engineers. You have a set of tangible factors for comparison. You can measure the results of VE efforts in terms of hours and minutes or dollars and cents. Once proven, there is no argument against the fact that something happened and that it was beneficial. A few such test cases to document your presentation of information to management and you are in business.

A few case histories exist where a VE program was established and supported by management on a trial period basis for three to six months. At the end of this subsidized period, the efforts were evaluated. If the VE team could prove its worth, management would continue the effort; if not, the effort would be stopped. In the cases that I know of, the results have been successful. As we all know, “nothing succeeds like success.” Results speak most eloquently for themselves to both management and the customer.

Some ground rules must prevail, however, when trying to initiate such VE efforts. (1) Recommendations must be reviewed by the top management team for either a go-ahead or rejection on the basis of accepted engineering knowledge. Emotions are ruled out as a basis of rejection.

If a decision has been made to continue the study, operating budgets that receive benefits from the change are then transferred to a special account. The VE group has authority to issue work orders to complete implementation of the VE study. Funds for this effort are provided from the special account. Implementation actions are scheduled much in the same manner that a production or engineering action is scheduled for implementation. After the implementation is complete, there should be a review to verify and adjust, if necessary, the savings that were predicted and such savings should be transferred to a holding account...otherwise the savings tend to disappear.

Let me throw in a word of caution. Be sure to be as conservative and as accurate as possible in estimating the total impact. Don’t overestimate. This is psychologically bad.

And finally, let me offer one other approach that may be used to establish the need for a VE program. Cite accomplishments achieved through VE programs in competing companies. Relate such accomplishments to areas in your company which are in need of cost reduction which you are reasonably certain will be recognized and accepted as lucrative possibilities by your management.

Once you secure agreement on these points, you will have a receptive audience as you suggest the solution—an effective value engineering program.

Let me summarize briefly the point that I have tried to make. I’m sure that we all agree that a need for value engineering exists. Selling an effective program can be accomplished by using the Goodwin approach: IDENTIFY the point of opportunity where a needed cost improvement exists; ISOLATE it by gathering facts and information to support the PROMISE to give results. Select and present enough supporting information to prove your point and build management’s confidence in your ability to deliver good results and then IMPLEMENT your VE program actions.

Document tangible results in Dollars and Cents, or Hours and Minutes in order that your program may be evaluated on the basis of results produced.

You, your company and your country will reap significant benefits!!

★★★
Three “Musts” for a Value Program

by EDGAR R. LOWER
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A successful Value Engineering program calls for a proper balance of emphasis. Training, reporting systems, audit procedures, etc., cannot by themselves guarantee a dynamic total value program. In a relatively new field of endeavor it is possible to emphasize one or more aspects of Value Engineering in an attempt to stimulate the program. A dynamic total value program requires the proper balance of three elements: 1) the design and implementation of an effective planning and control system, 2) a training program coordinated and integrated with the system developed, and 3) a research program aimed at discovering and adopting new techniques and new methodology to provide for expanded and more effective applications.

Value Program Management

In the last twelve years, the Army Management Engineering Training Agency (AMETA) has seen programs, aimed at improving certain phases of management, rise and fall and many times rise again. Normally, these programs arise during times of crisis to “put out a fire.” After the apparent crisis, the program declines through lack of interest. When another exigency arises, the program is revived, redressed, and prepared for action. The above cycle can be compared to the battlefield situation where the soldier shoots at the targets as they show their heads. Present battle situations attempt to prevent the enemy from ever showing their heads. Our management programs should be geared to continually improve management and prevent fires, rather than put them out as they occur. Cyclic processes are expensive, only partially successful, and do not result in maximum benefits to all concerned. Successful programs that do not vacillate occur because management people care enough to implement a truly effective planning and control system. Such systems do not occur by chance but are designed, bearing in mind good system design principles. AMETA, in its consultant capacity to the Army and to the Federal Government, designs management control systems and recommends the implementation of these systems.

AMETA believes that a truly effective value program requires top-down planning and control of the total program through a system that will provide assurance that the program is operating at an appropriate level, specifically:

1) Assurance of a total value program throughout the entire life cycle of the equipment (weapons system) from the inception through phase-out of the equipment.
2) Assurance of a proper level of effort through all phases of the program to meet or exceed cost reduction goals.
3) Assurance that effort is being concentrated on projects that result in the greatest monetary benefit for the time and money being expended.
4) Assurance of proper utilization of resources, both manpower and money.

The above-mentioned requirements indicate the need for a management system that accomplishes the following:
1) Forces developing and implementing of plans by management at all levels.
2) Provides a measure of accomplishments against the pre-established goals, and the means of taking appropriate corrective action when needed.

The type of program outlined above operates under the philosophy that true control can only be applied at the point of the performance to be controlled. The value planning and control system requires the establishment of objectives, the formulation of plans, the development of schedules, the determination of appropriate measurement procedures, the design of adequate reporting procedures, and the means of taking appropriate corrective action.

The specification for a management system leading to a total value program consists of the following:

1) Complete planning, by the major department (or command) in the form of Top Level PERT Network, including top management-prescribed milestones, for the implementation of program objectives.
2) Similar planning, involving more detailed networks and the assurance of planning on the part of plants, laboratories, installations, and activities. This includes planning of accomplishment toward specific goals (targets) in terms of total equipment (weapons system) cost reduction through value engineering.
3) The development of detailed schedules that translate the plan into a time table with specific dates for the occurrence of the events. The schedules must assure all levels of management of the timely accomplishment of the plan.
4) Projection of resources, in the area of manpower and money, necessary to meet the established schedules.
5) Projection of value training required to correspond to the resource projections and to support the detailed program plans.
6) Total measurement of accomplishment by all intermediate management levels against the pre-established goals.
7) Establishment of a penalty and bonus concept (similar to a quality control program) of reporting and verification to include on-site evaluation of the plants, laboratories, installations, and activities of a value pro-
program management system. Thus, as an example, if a department (or installation) has a good value program that meets necessary requirements, the department (or installation) does less reporting and receives fewer inspections than one that has a poor value program.

8) Means of evaluating the effectiveness of the value program at all levels, along with the penalty and bonus concept mentioned above, would be means of taking necessary corrective action.

9) Utilization of intermediate management levels (or commands) as middle managers of the value program. This requirement would allow for two types of actions, namely (1) the evaluation of the department (or installation) program with the prerogative of taking corrective action; and (2) the supply of on-site assistance (or consulting services) by the intermediate management level (or command) to the department (or installation).

The above-outlined plan for a total value program is presently under consideration for development for the Army Materiel Command through AMETA. Such a system can be designed and implemented with beneficial results in terms of reducing the cost of defense materiel.

**Value Training Program**

An effective value program requires a coordinated and integrated value training program to support the detailed plans. Value training should be provided to all persons who in any way will affect the cost of the product. This means that anyone who works on or makes decisions relative to items of equipment (or defense materiel) needs value education. Thus, a complete value training program must include provisions for this education for management, operating personnel, value specialists, and value program managers. To meet this challenge, courses of different length and different subject material are necessary. To satisfy, economically, the types of training mentioned above requires that certain value training courses be conducted on-site (at the plant, laboratory, activity, or military installation) and other types of courses be conducted at a centralized location. Total demand for the various courses essentially determines whether it is more feasible to conduct the course on-site or at a centralized location.

Top managers can easily kill a program through indifference; they must be sold on Value Engineering and sold on their important role in the successful program.

Middle managers must learn what Value Engineering consists of, why it is important to the success of doing business at the present time, and why they should support this vital program. Normally, these people would not be involved in making value studies themselves. However, in most cases the people who work with them would be involved either directly or indirectly in making, supporting, or implementing value studies.

The operating personnel may serve on a Value Engineering study team or may be called upon to assist in the conduct of the study; thus, they must be skilled in Value Engineering and the means of doing a value study.

The value specialist will be given responsibility for implementation of the Value Engineering program; thus, he must be skilled in Value Engineering, as well as the interrelationship of Value Engineering with other related areas.

Value procurement specialists that are responsible for negotiating, reviewing, approving, administering, and managing and evaluating Value Engineering efforts of contractors need a course that will familiarize them with the complex job of managing the program through the efforts of others.

Many technically competent engineers move to the position of Value Engineering Managers. However, a large number of these managers have never had training dealing with planning, organizing, and controlling the total value program. This course would provide training to assure more competent management of the program.

The above-recommended courses can be summarized as follows:

- **Top Management (8 hours)** — intended to provide value orientation training for top and key management personnel.
- **Middle Management (20 hours)** — intended to provide value training for heads of operating departments.
- **Operating Personnel (one week)** — intended to provide value training to operating personnel so they will practice Value Engineering in their daily work.
- **Value Specialist (two weeks)** — intended to provide value training for specialists with engineering and production backgrounds.
- **Value Procurement Specialist (one to two weeks)** — intended to provide value training and value contract management training for specialists with engineering, procurement, and contracting backgrounds.
- **Value Engineering Program Management (one week)** — intended to provide training on how to manage the value program and on evaluation of contractor's value programs.

At the present time, the Army Management Engineering Training Agency conducts the value specialist training course at their centralized location on Rock Island Arsenal, Rock Island, Illinois. The Agency is considering adding to the curriculum those courses recommended for presentation at a centralized location. Courses recommended for presentation on-site should be standardized, within limits, by a central training group or organization within the company or military service so that all personnel receive a similar type of value training.

**Value Engineering Research**

In the rapidly advancing field of Value Engineering, a dynamic total value program and a vigorous training program call for research aimed at discovering and adopting new techniques and new methodology to provide effective applications. Although Value Engineering has made impressive gains in the past fifteen years, the profession, if it is to enjoy continuing progress, must advance on all levels to raise its stature and its productivity. These objectives can best be accomplished through a strong research program that has been designed to improve current Value Engineering methods.

For some period of time, staff members at AMETA, practicing Army Value Engineers, and members of the Department of Defense have felt the need to advance the state of the art through a research program directed toward elevating Value Engineering to that of a more quantitative engineering science. In this regard, in 1962 a staff member of AMETA met in Washington, D. C., with Army Value Engineers to formulate Value Engineering research projects. A sum of money was set aside for these research projects, and AMETA was directed to monitor
the accomplishment of this effort through the use of personnel in industry and universities. The six research project areas initially established are as follows:

1) Process and Material Selector Guide — A single, integrated guide to aid in the selection of proper fabrication processes and engineering materials based on design characteristics of the product, process capabilities, engineering properties of materials, along with special emphasis on relative costs.

2) Costs of Making Value Changes — A means of identifying the various costs that result when Value Engineering change proposals are implemented. These costs could result from changing specifications, changing blueprints, changing supply manuals, changing contracts, taking procurement actions, carrying different items in the supply system, administering performance tests, etc. Since many of these costs are not readily obtainable from cost accounting systems, a second part of this project is to develop means of determining them.

3) Causes of Low Product Value — A determination of the factors which cause low product value relative to functional requirements of the product during research and development, product engineering, procurement, maintenance, storage and use.

4) Quantitative Measurement of Values — Would include methods of weighting objectives such as performance, time requirements, quality of design, reliability and function. This project could be accomplished in several phases. The first phase would be the identification and adaptation of already-known techniques from the areas of operations research, engineering economy, industrial engineering, and mathematical statistics that could serve as means of measuring value. The second phase would be a longer range program of basic research to explore and develop more sophisticated means and techniques for measuring value. These measures of value should include a total value concept permitting the measurement of the value of an entire weapons system.

5) Selection of Value Engineering Projects — A way of selecting systems (or items of military defense hardware) to be subjected to value engineering study projects. The outcome of this project would provide means of identifying and delineating areas of greatest opportunity for value study projects.

6) Relationship of Value Engineering to Other Functional Areas — An analysis and evaluation of the relationships, compatibility, and scope between value engineering and other functional areas such as quality assurance, reliability, maintainability, and standardization.

Research work has been started in a number of the above research areas. To date, most of the research work is being accomplished by consultants from universities, industries, and government. Because of the nature of research work, in many cases it is too early to report substantial results. The following results can be reported at this time:

1) Process and Material Selector Guide — The selector guide sheets are being prepared to be published in handbook form under the Army Design Engineering Handbook Series. The handbook will have the following sections:
   a. Selector Guide for Primary Forming Processes
   b. Selector Guide for Materials

c. Selector Guide for Secondary Processes
d. Selector Guide for Finishing Processes

Work has been completed on Selector Guide for Primary Forming Processes, and the handbook has been printed in limited quantities. A FORTRAN computer program, based upon information in the selector guide, has been prepared to aid in the selection of basic processes. Development of the Selector Guide for Materials is progressing and publication expected before the end of 1964.

The output of the other research projects will be published as technical reports as soon as the information becomes available.

In addition to the above-mentioned areas, there are a number of other areas of value engineering that AMETA feels need researching. These are:

1) Establishment of Valid Value Weapon System Target Costs — A method of predicting the use value cost of military weapons systems for the purpose of establishing target costs to be used during the development and design phases of the product life cycle.

2) Cost Avoidance During Development Phase — A means of determining or estimating fairly accurately how much money is saved when a design change or material change is made early in the development phases of a weapons system project. With the increased emphasis in the Department of Defense on cost reduction, the services need better information for arriving at how much cost was avoided by making the above-mentioned type of changes.

3) Development Phase — Value Engineering Plan — The value engineering plan and technology are fairly well developed for use in analyzing and improving value in already known pieces of hardware, but is not as well developed during the development and testing phases of weapons acquisition. A better technology and plan must be developed to handle value studies during development and testing.

4) Cost Estimating Handbook — A handbook that could be used as a guide by design, development, product and process engineers, value engineers, and procurement specialists in estimating the cost to produce various types of components.

5) Value Cost Models — Certain people working in the area of value are attempting to develop value cost models similar to reliability models.

6) Value Standards — The development of value standards using mathematical expressions for the function and the cost of providing the function should be investigated. Measurable parameters (for functions) such as transmit torque, support weight, and conduct current can be accurately calculated using the laws of physics; and the dollar value can be assigned from the market price of the material having the measurable parameter.

Summary

The Army Management Engineering Training Agency is convinced that a well-rounded value program must include the following:

1) An effective value program that has been properly planned and controlled. This type of program requires the establishment of objectives, the formulation of plans, the

Continued on page 35
Implementing Value Engineering During System Design and Development

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Three basic conclusions affecting the future of Value Engineering were reinforced by the proceedings at the 1964 National Convention of the Society of Value Engineers. These conclusions are:

1) To survive, Value Engineering must change from the "art of the practitioner" to an engineering discipline.
2) The best Value Engineer is the Design Engineer himself.
3) Emphasis must shift from "after the fact" VE to implementation during initial design.

Value Engineering has achieved a position of prominence nationally as a cost reduction tool. VE training and attention has concentrated upon changing existing designs to obtain reduced cost. The Aero-Space Industry, in attempting to put this concept to work, has found that concurrency, limited production runs, incremental procurement policies, and rigid configuration control, inhibit design change implementation after production release of the initial design. Redesign and testing costs generally equal or exceed the savings potential for items on contract at the time of change initiation and thus decrease the opportunity to make or propose Value Engineering changes. The industry must become skilled at applying VE progressively during initial design phases, so that the final drawings as initially released for production contain the optimum marriage of all design parameters including cost.

This paper deals with Value Engineering following award by the Government (Department of Defense or National Aeronautic and Space Administration) of a contract for Research and Development of a selected system concept. Prior to this award, Government and Industry have conducted a series of system concept studies aimed at defining the concept that solves a particular military or space requirement. During these studies, consideration of the technical and economic feasibility of alternate system concepts result in the development of mission and performance criteria for a selected system (i.e., mission, range, payload, gross weight, response time, operating environment, service life, reliability goals and maintenance concept). Cost Effectiveness Studies of these concepts provide a major influence in the Government's ultimate decision to proceed with R&D. However, these cost studies do not develop the detail necessary to establish cost as a design parameter. Value Engineering must determine a method of elevating cost to a position of equality with other criteria, (range, payload, weight, reliability, etc.).

Following the decision to proceed, design development during R&D consists of three general phases; 1) Systems Requirements Analysis, 2) Preliminary design and 3) Detailed Design. Examination of these three phases shows that each follows the steps in the Value Engineering Plan. The System Requirements Analysis phase parallels the "Information Period" of the Plan. The Preliminary Design phase corresponds to the "Speculative" and "Analytical" periods. The Detail Design phase follows the steps included in the "Program Planning and Execution Period." While the resulting design is reasonably cost effective, the designer has achieved his results by intuitive cost methods rather than by a systematic and scientific application of cost visibility tools.

The general tasks for the Research and Development Contractor in these phases are to:

1) Translate the weapon system criteria into functional areas.
2) Reduce the functional areas to discrete functions.
3) Establish the technical requirements for each function.
4) Combine related functions and technical requirements into preliminary hardware definition.
5) Perform preliminary design analyses and recommend a design solution that will satisfy the technical requirement.
6) Prepare the detail design drawings.
7) Release design for test.
8) Accomplish tests and evaluate results to determine conformance with the original weapon system criteria and detail design requirements.

Value Engineering must complement these tasks with; timely cost intelligence phased to suit the particular needs of the design specialist, predicted production (hardware) cost targets for use during design, measurement of design achievement against the cost targets, timely feedback to design when cost targets begin to be exceeded.

Value Engineering During Weapon Systems Requirements Analysis

In theory, during the functional definition phase, the Systems Analyst should have no concern with cost. He analyzes the system criteria and defines the functions that must be accomplished to meet the criteria. He is not concerned with cost, hardware, state of the art, or productivity. His functional flow diagram provides a road map for all subsequent design and operational analyses, and consequently, he must concentrate attention on precise functional definition. He challenges the criteria in the interests of achieving a better understanding; he challenges the function to obtain a more precise definition.
This approach is essential to the orderly systems development. Provided the functional analysis defines pure and precise functions that allow latitude in the selection of alternative design solutions, Value Engineering’s contribution consists of planning of cost data to be provided during subsequent steps. However, today’s Systems Analysts grew up on the drafting boards preparing hardware designs. Instead of pure functions, he frequently chooses a function that restricts the latitude of choice in the selection of alternate design solutions. When this occurs, Value Engineering can contribute materially to ultimate cost effectiveness by promoting functional definition that permits ingenuity during later design phases.

Value Engineering can make a contribution when the System Analyst establishes the technical requirements and combines related functions into hardware definition. Decisions made at this time by the Systems Analyst in defining the technical requirements establish the boundaries and parameters for Preliminary Design and thus substantially influence the resulting hardware cost. The analyst needs cost insight into the effects of technical requirements upon development, production and operational costs during subsequent design phases. Value Engineering, in this phase, must provide the analyst with comparative cost data for alternative methods of: 1) accomplishing functions, 2) establishing function grouping and 3) the impact of various design constraints upon cost.

Value Standards, expanded in scope to include general functions, offer a potential tool for application during systems analysis. Properly constructed, such Value Standards will provide the systems analyst with a cost tool permitting measurement of the relative cost impact of any one, or a combination of functions and technical requirements.

When the optimum functional grouping and the technical requirements before firm, a preliminary predicted production and operational cost target that identifies production (labor, material and tooling) costs and operational costs is prepared for use during the next design phase.

Value Engineering During Preliminary Design

During this phase, the designer develops the design solution that performs the function, meets the technical and operational requirements, and can be produced and operated within the predicted cost targets previously set. Initially, the designer, following a period of research, constructs a layout or schematic of alternate design approaches. These alternatives are subjected to an initial design analysis (weight, stress, performance, reliability, maintainability, etc.) and rated for technical effectiveness. An initial cost analysis of each alternative design approach provides an additional dimension which, when rated along with the technical and operational considerations, allows selection of the most effective design solution. To provide the designer with total cost visibility for alternate design solutions, the cost analysis must include development, operating and maintenance costs in addition to tooling, manufacturing labor, material and purchased equipment costs.

The initial cost analysis contains the major cost elements, so that high cost areas within each concept can be identified. As the design narrows to one or two approaches, the cost analysis grows in detail until all the cost features of the proposed design are visible. The development of the cost analysis is an iterative process just as is the design itself. With the final selection of one design approach, predicted production cost targets are established and approved.

The role of Value Engineering during this preliminary design phase is (1) to insure that the designer has adequate cost intelligence on time for decision purposes and (2) to identify the areas of high cost so that alternative designs can be developed that will reduce the cost. The responsibility for final decision rests with the designer.

Value Engineering During Detailed Design

Upon completion of preliminary design, the role of Value Engineering assumes a different character. Effective application during the previously described design phases should establish gross or overall maximum value. The major high cost decisions have been made. The remaining choices for greater value consist in a selection of material, manufacturing process, tolerance, finish, component parts and purchased equipment. Costs for these choices are reasonably well documented in catalogs, handbooks, literature and standards. The size and complexity of the detail design task limits the ability of the Value Engineer to add much in the way of knowledge other than to improve the quality and applicability of the data already available to the designer.

During the detail design phase, Value Engineering must shift attention to the development of a cost control and reporting system that provides the designer and his management with a vehicle for early detection of cost trends. A means of estimating the predicted cost for producing and operating an end item of hardware as it progresses from start to completion of detail design is necessary. Periodic cost trend reports to the designer are timed so the designer can concentrate on areas that are causing unfavorable production or operational cost trends. Where difficult choices demand cost data that it not readily available, the value engineer can assemble a task force to dig out the necessary information. Recommendations from such a task force will assist the designer provided the study is completed in minimum time. Generally speaking, however, the major effort of Value Engineering at this stage of design produces the greatest value to the system by analyzing cost data and establishing a feedback loop to the designer with regard to his particular end item as he completes each detail of design.

Summary

For maximum effectiveness during systems design development, the Value Engineering contribution must complement the design process. Accomplishment of this can be achieved by:

1) Improving functional definition skills.
2) Providing cost visibility to the system analyst and the designer constructed and timed to permit cost effective design decisions.
3) Establishing predicted production and operational cost targets early in the design development cycle as one of the design parameters.
4) Developing a cost feedback loop that, during the design process, informs the designer of his progress in meeting the predicted cost target.
policies within contractor organizations. At the same time it explores questions of motivation, risk, uncertainty, and business behavior which concern social scientists.

The author, Frederic M. Scherer, is Assistant Professor of Economics at Princeton University; he was formerly Research Associate at the Harvard Business School. 1964

\$7.50

Western Periodicals Company of North Hollywood, California, has obtained exclusive rights to publish and distribute the "Northrop Learning Curves for Cost Improvement," it was announced jointly by John E. Oliver, Northrop Corporation, Product Licencing, and Sol J. Grossman, President of Western Periodicals. This marks the first time these tables have been made available from a commercial source.

Developed on Northrop's 7090 computer, these volumes offer in one presentation both straight line unit and straight line average curves covering the complete range of 51% through 99% in increments of one percent.

Cost improvement curve tables have been used successfully by Northrop for the past eleven years in contract negotiations. They have proven to be essential tools for the application of cost control and projection techniques to procurement, planning, scheduling, budgeting and estimating functions.

Western Periodicals will publish the tables in six volumes which will be available in complete sets only. Volume 1 is the 51-59% group; Volume 2 is 60-69%; Volume 3 is 70-79%; Volume 4 is 80-89%; and Volume 5 is 90-99%. Volume 6 is a summary volume with the tables in increments of 5% running from 55% through 95%.

**Computer Industry has Own Newsletter**

Those members of the value engineering profession who interface with the computer industry, or whose work is closely related with information processing, should become acquainted with a new newsletter now being published covering information in this specialized field. We refer to Computing Newsline published by Phyllis Huggins, Box 497, Santa Monica, California. This excellent newsletter is published bi-weekly and is available at a regular mail subscription of $22.00 per year. Huggins is also a consultant in public relations and was responsible for the excellent coverage which the Society received in the 1964 National Meeting in Los Angeles.

**National Referral Center**

**Aids Technical Researchers**

For value engineers and others engaged in technological research, the National Referral Center for Science and Technology, supported by the National Science Foundation, is an excellent target at which queries can be directed for obtaining leads to vast sources of information. The services of the National Referral Center, a function of the Library of Congress, are available without charge to anyone interested in science and technology.

The Center's three principle tasks are: 1) to establish and maintain a comprehensive register of significant information resources in all fields of science and engineering; 2) to provide referral service, directing inquiries to resources that can satisfy informational needs, and to publish guides and directories; and 3) to analyze the entire existing science information complex.

The Center has thus far identified some 8,800 information resources, contacted about 5,500 of them. About 2,000 of these have been fully processed and recorded. The Center began its referral service in March 1963, and has since answered almost 1,600 inquiries.

Inquiries may be submitted by phone or letter, according to Mrs. May Spiros, Assistant for Publications, and no special form is required. You will be provided with names and addresses of organizations and institutions capable of supplying the information you need. She asks only that your subject interest be clearly defined, and that you indicate the sources with which you are already familiar: Write to: National Referral Center for Science and Technology, Library of Congress, Washington, D. C. 20540

**MINUTES — BOARD OF DIRECTORS MEETING**

The first meeting of the Board of Directors for the 1964-65 term of office was called to order at 3:30 P.M. on April 24, 1964 at the Ambassador Hotel in Los Angeles, California, on the above date by F. S. Sherwin, President and Board Chairman.

Directors present: R. J. Gillespie
P. A. Radcliffe
J. W. Edwards
E. D. Heller

Directors absent: F. J. Johnson
D. B. Burton

Officers Present: F. S. Sherwin
J. J. Kaufman
C. E. Harris

Committee Chairmen:
H. Smith
present: W. Thompson
R. Radula
A. B. Tocco
R. R. Bidwell

Approval of Minutes of Last Meeting

The minutes of the 31 January 1964 Board of Directors meeting were approved as submitted.

**Introductory Remarks by Old and New Presidents**

A. R. Tocco — In the opening remarks by the past president, (1963-64) A. R. Tocco expressed his appreciation for the support he had received during his term of office. In detailing the goals and accomplishments of the last year, Past President Tocco emphasized the necessity for carrying forward those tasks due for completion during the present year. Mr. Tocco offered his services to the Board of Directors to assist in the coordination of the carry-over assignments to be completed.

F. S. Sherwin — Chairman Sherwin commented on the necessity for closing the line of communication between the national and local chapters. In developing plans for active coordination with state chapters, Mr. Sherwin discussed the establishment of three presidential advisory positions to include:

1) Programs — to develop a board national program including objectives, goals, milestones.
2) Professional stature.
3) Membership.

Also required is the necessity for detailed review of issues coming before the board, and for more rapid implementation action.

Mr. Sherwin called for recommendation of members to serve as chairmen, or on current committees.
Treasurer's Report — C. E. Harris
C. E. Harris submitted a written report and re-emphasized the necessity for each officer who normally requires Society operating funds to submit a budget for approval within 60 days after taking office. Mr. Harris expressed concern over the balance of expenditures to income and stated that without the generous financial support of industry, the Society would not be solvent.

Secretary's Report — F. S. Sherwin
Submitted at Annual Business Meeting.

Committee Reports
Publications — Bill Thompson — Mr. Thompson commented that there was a back log of technical articles for future issues of the Journal resulting from the inputs for the 1964 National Meeting. It was proposed that a professional technical publishing house be selected to handle the business routine of the Journal, with liaison provided by the Publications Committee. Chairman Sherwin requested Mr. Thompson to submit a written report covering the above proposal.

A major problem facing the Publications Committee is the lack of advertising; and an appeal was made to the Board of Directors to encourage their districts to bring in new ad accounts.

A motion by E. Heller approving the release of $1,200 by May 1, with subsequent financial aid of $1,000 in July '64, $1,000 in October '64 and $1,000 in February '65, to publish the Journal was seconded and carried. (5-0)

Systems & Procedures — D. L. Gleason

There is an immediate need (said F. S. Sherwin) to have available a clear set of systems and procedures to conduct the business of the Society on a uniform national basis.

The interface between this committee, and the Rules and Bylaws Committee was discussed. It was noted that the work of the Rules & Bylaws Committee directly affects the systems and procedures. Therefore, both committees should operate as branches to a single committee coordinator.

Measurement — Hal Smith

The objectives of this committee were reviewed with emphasis on arriving at methods of measuring the effectiveness of a V. E. program in industry by essential elements. It was also suggested that this committee coordinate with the EIA, through Harry Martin who is currently assigned to a similar objective.

Mr. Smith indicated that there are twelve members currently serving this committee. Interim report submitted.

Education — Bob Gillespie
Among the various national inputs to this committee, Mr. Gillespie cited those tasks closest to completion and ready for approval and publication.

3) Professional Capabilities for Value Instructor — H. P. Williams (due date not set).
4) V. E. Problem Solving — ready for publication in two weeks pending Directors’ approval.
5) Speakers List and Slide Presentation — ready for publication in two weeks pending Directors’ approval.

1965 National Meeting Location

Reviewing the past transactions leading to the location of the 1965 National Convention, two proposals were submitted and considered.

1) The formal proposal prepared by the Paul Revere Chapter (March 1964)
2) The Texas proposal submitted in 1963 and carried over to be considered for the 1965 convention.

In reaffirming the decision by the past Board of Directors to hold the 1965 convention in Boston, a motion was restated by W. Edwards and carried (5-0) favoring this location.

Therefore, the 1965 convention will be held in Boston, with the Paul Revere Chapter as host. Bob Radula will be convention chairman.

The date of the convention will be the last week of April, or July 1, 1965, pending the approval of the constitution. * * Proposes changing fiscal year end from April to July.

1966 National Meeting Proposals
Final date for submittal of proposals for content and location for the 1966 National Meeting is September 1, 1964. Chapter Chairman please note.

The proposals should be presented as a complete formal report with emphasis on location, scope, theme and cost. A recommendation was made that the next National Meeting be held on a Monday and Tuesday, which would allow two full days of participation. This would also relieve the transportation problem of “getting home” on a weekend.

Legal Counsel 1964-65
A motion submitted by Chairman Sherwin awarding Len Williams, Attorney at Law, a $50 per month retainer covering "normal" legal services required by the Society, was seconded and carried (4-0). One director (Radcliffe) left early.

Other Old Business
A motion was made and carried declaring the 1963 election valid, thereby granting the secretary permission to destroy the ballots of that election. Ballots of 1964 election to be retained by secretary for at least three months.

New Business
The secretary, J. J. Kaufman, requested a $500 advance against approved secretarial expenses be awarded for business items not normally expected to be carried by the parent company. Request approved as a motion and granted.

Ed Heller proposed the initials SAVE be considered as “The Society for the Advancement of Value Engineers”. Comments and discussions are invited.

Time and Place for 1964-65 Board Meetings
The time and place of the board meetings covering the current fiscal year were discussed and scheduled as follows:

First week August — New England
Third week October — San Francisco
Third week January — Florida

Exact dates and places will be published in the near future.

Adjournment
The meeting was adjourned at 7:20 P.M.

(J. J. Kaufman, Secretary) Society of American Value Engineers

* * *

“Imagination is more important than knowledge.”

“EINSTEIN”
Directory of S.A.V.E. Chapters

NORTHEAST REGION

Director: Robert J. Gillespie
Director of Value Engineering and Cost Reduction
Sylvania Electronic Systems
40 Sylvan Road
Waltham, Mass.

Connecticut Valley Chapter
Chairman:
Henry W. Halverson
Sikorsky Aircraft Company
North Main Street
Stratford, Connecticut

Massachusetts
Paul Revere Chapter
Chairman:
Donald Madden
Cambridge Plating Co.
24 Spring Road
Weston 93, Massachusetts

New Jersey
North Jersey or Newark Chapter
Chairman pro tem:
Arthur Wojtowicz
Value Engineering Coordinator
The Bendix Corporation
Ecilpse-Pioneer Division
Teterboro, New Jersey

New York
Metropolitan New York Chapter
Chairman:
Clyde Winstead
Huyck Systems
Huntington Station
Long Island, New York

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Carrier Corporation
Carrier Parkway
Syracuse 1, New York

Mohawk Berkshire Chapter
Chairman:
Morris Lapidus
V.A. Education and Training
U.S. Army Ordnance
Watervliet Arsenal, New York

Niagara Frontier Chapter
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Chief, Value Analysis Office
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J. W. MOON is Chief, Value Analysis-Vehicles, Ling-Tempco-Vought, Michigan Division. He received his Mechanical Engineering Degree from General Motors Institute, and has worked in liaison, design, development, cost reduction and value analysis for eight out of thirteen years at Hydra-Matic Division of General Motors. Value Engineering savings in both commercial and defense industries totaling approximately $30,000,000 in the past four years has been an outstanding achievement of his. He received formal V.E. training from Value Analysis Incorporated and the University of Michigan and has been an advisor on development of General Motors V.E. training programs. He is now teaching courses in value engineering and is President of the Detroit Chapter of the Society of American Value Engineers.

J. G. LITTLEJOHN, Chief of Value Analysis, LANCE Project, Ling-Tempco-Vought. He graduated from East Texas State College in 1950 with a BS Degree in Mathematics. Littlejohn joined LTV in 1948 in Tool Manufacturing and has advanced through various responsible positions until his appointment in 1959 as Tool Project Engineer of all Subcontract Programs, which included the B-70 effort at LTV, with the responsibility of all Manufacturing Engineering effort for the B-70 components. In 1963 he was appointed to his present position as Chief of Value Analysis, and is responsible for all Value Analysis effort on the LANCE Missile System. He has been active in the American Society of Tool Manufacturing Engineers (ASTME) and Society of American Value Engineers.

ROBERT HINES is Manager, Proposals, in RCA's Communications Systems Division in Camden, New Jersey. A graduate of the University of Virginia, he is concerned with RCA's response to changing defense marketing requirements. His twelve years with Minneapolis-Honeywell, Burroughs Corpora-

tion, and RCA include experience in proposals and marketing of instrumentation, digital computers, and aerospace systems.

ERVIN LESHNER is a registered professional engineer, with 24 years of diversified design and management experience. He has operated his own manufacturing business and has pioneered many new developments in the electronics field. He is Administrator of Defense Value Improvement for Defense Electronic Products of RCA, where his responsibilities include the implementation of value improvement programs within all divisions of Defense Electronic Products. Mr. Leshner holds 16 patents of electromechanical and mechanical devices.

ROBERT CARNINE has had 23 years experience in engineering and program management, resulting in numerous patents and technical papers. At Hughes Aircraft Co., Culver City, California, Carnine is responsible for administration of all Value Engineering and cost control activities within the Guidance and Controls Division. He is a member of S.A.V.E. and an active participant in various trade association committees.

ROBERT L. BIDWELL, Manager of Value Analysis Administration, Martin Company, Division of Martin Marietta Corporation, is a U.S. Army veteran (Lt. Colonel, ret.) whose service spans a quarter of a century with the Air Corps, Quartermaster Corps and Ordnance Corps. More than half of this service has been directed toward industrial efforts, providing him with a rich and varied background for the responsibilities which he assumed at Martin in May 1961. For seven years with the San Francisco Ordnance Procurement District, Colonel Bidwell served in such capacities as Executive Officer, Contracting Officer, War Manpower Representative, Labor and Deferment Officer, and later, for three years, acted as advisor to the Netherlands Government on building, maintenance and organization of a Supply and Maintenance Depot System. Joining Martin shortly after his retirement from active service, Bidwell assumed managership of the company’s Value Analysis Program, which has contributed more than $18,000,000 in operating cost reductions during the past year.

EDGAR R. LOWER is an Industrial Engineer in the Industrial Management Department of the U.S. Army Management Engineering Training Agency at Rock Island Arsenal where he has a major responsibility monitoring an extensive research program in value engineering. Receiving the BSME degree from the University of Illinois, Mr. Lower has been associated with Wright-Patterson Air Force Base, Aberdeen Proving Ground, and Alcoa. He is President of the Mississippi Valley Chapter of the American Institute of Industrial Engineers and a member of S.A.V.E.
E. W. DEARBORN, Supervisor of Systems Cost Effectiveness, Missile Branch, Aero-Space Division at The Boeing Company, is responsible for implementation of Value Engineering in Boeing's missile and space development programs. Educated at the University of Washington, his sixteen years at Boeing has included extensive experience in the fields of Sales, Contract Negotiation, Cost Estimating, Price Analysis, and Logistics and Service Engineering. Prior to joining Boeing, he served in the Air Force as Pilot, Operations Officer and in Maintenance and Supply. Active in the Northwest Chapter of the American Institute of Aeronautics and Astronautics, he is a member of the Northwest Chapter of S.A.V.E.

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INFORMATION FOR CONTRIBUTORS

PAPERS: Papers submitted for consideration must be on subjects of interest to Value Engineers or organizational functions dealing with Value Engineering. All material must be new, never previously published. The subject matter must be new or must present new data, new material, or a new viewpoint to a subject previously treated. If authors are in doubt, they should submit an abstract of the proposed paper, pointing up in what way the material is new, or highlighting the new viewpoint, for review by the editorial staff.

MANUSCRIPTS: All manuscripts should be addressed to the Technical Editor, Journal of Value Engineering, P.O. Box 45323, Los Angeles 45, California. Each unsolicited manuscript must be accompanied by a self-addressed stamped return envelope. Each manuscript must be accompanied by written assurance as to security clearance in the event the subject matter lies in a classified area or if the paper originates under government sponsorship. Full responsibility rests with the author for permission to publish profiles of living persons. The Society has prior publication rights to any paper presented at its meetings.

Manuscripts must be typewritten, double-spaced, and on one side of the page only, with wide margins to allow for instructions to the printer. Use standard size (8½ x 11) good-quality bond paper. Start the first page of each article about half-way down the page. Short articles and notes which may qualify as technical notes and news items are welcome.

TITLES AND AUTHOR'S NAMES: The title should be brief. Lengthy titles will be shortened by the Editor. The author's name should be typed on the line below the title, and it is preferable to use the full name. The company affiliation should follow on the next line, with the author's official title given in a footnote.

ILLUSTRATIONS: Line drawings must be clear and sharp to make clear engravings. Use black ink on white paper or tracing cloth. Photographs should be glossy prints, not matte or semi-matte, and should preferably be 8" x 10". Each illustration or photograph must have a caption, and should include the contributor's name and address. All photographs submitted will normally be retained in the Journal files, unless their desired return is specifically stated.

TABLES: Whenever possible, tabular matter should be submitted in a final form suitable for reproduction and planned to fit the page dimensions of the Journal. Avoid tables which have to be printed sideways. Each table must have a table number and a caption, and must be referenced in its accompanying text.

AUTHOR'S PHOTO AND RESUME: It is requested that authors whose material has not previously been published in the Journal submit a small portrait photograph of themselves and a brief biography of not more than fifty words.

ABSTRACTS: When an abstract is submitted, it should be in less than 200 words and written as a single paragraph. It should be a summary, not an introduction, and complete in itself. It should indicate the subject dealt with in the paper and should state the objectives of the investigation.

ALTERATIONS: Take great care that the manuscript is graphically correct. A limited number of alterations in proof are unavoidable, but the cost of making extensive alterations in proof as a result of an inaccurate or unclear manuscript must be controlled. Your cooperation and assistance will be appreciated.

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Journal of Value Engineering

( Lower) Continued from page 27

development of schedules, the determination of appropriate measurement procedures, the design of adequate reporting procedures, and the means of taking appropriate corrective action.

2) A complete training program that includes courses for all people who in any way will affect the cost of the product. Value training courses of differing scope must be provided for management personnel, operating personnel, value specialists, and value program managers.

3) The Value Engineering profession must be enhanced through an active Value Engineering research program aimed at advancing the state of the art of Value Engineering. The research projects should develop new approaches and more sophisticated tools for generating value in complex weapons systems. This type of program must fulfill immediate research objectives through applied research projects and fulfill long range objectives through basic research projects.
August 13, 1964

To Members of SAVE:

We should all recognize the challenge and opportunity which exists today in the systematic application of value engineering principles to the development of logistic support for DOD systems and equipments. This is not a new horizon—Tony Tocco directed SAVE's attention to the amalgam of Maintainability and Value Engineering in his President's Message in the June 1963 Journal of Value Engineering (Vol. 1, No. 4). In addition, you will recall that the theme of the January 1964 issue (Vol. 2, No. 2) pointed out the interrelationship of disciplines contributing to systems effectiveness. Renewed emphasis, however, is now particularly timely, concurrent with the issuance of DOD Directive No. 4100.35 - "Development of Integrated Logistic Support for Systems and Equipments".

This Directive defines integrated logistic support, establishes DOD policies and objectives governing this support for systems and equipments, and assigns program responsibilities. Copies may be requested from Col. John W. Breehl, USAF, Acting Director for Maintenance Policy, Office of the Assistant Secretary of Defense (Installations and Logistics), Room 4B854, The Pentagon, Washington, D. C.

Every defense-oriented value engineer should obtain a copy of this Directive, read it, understand its importance, and should provide the leadership to accelerate its implementation within his organization.

Sincerely,

Frederick S. Sherwin
National President
A backlog of 100 sets of Volume 2 (5 issues), plus the 1963 National Meeting Proceedings, are to be bound in hardback covers of library buckram leather, complete with silk screen lettering and the society's triangular symbol. These will be made available to SAVE members and other subscribers at the special price of $11.95 each. The number of bound copies is strictly limited to 100, which will be reserved for the first 100 orders received. Copies will be mailed postpaid shortly after publication of our October number, which will be the last in the Volume 2 series.

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(75c additional)