# HOW IT ALL BEGAN: THE CREATION OF EARNED VALUE AND THE EVOLUTION OF C/SPCS AND C/SCSC

By James B. Morin

But for the talent and dedication of a couple of visionaries, EVMS would likely not have even occurred or continued as the core performance measurement methodology for program management. With the passing of one of these visionaries, Gen. Hans 'Whitey' Driessnack in 2006, I was reminded of how much he contributed to the development of the Cost/ Schedule Control System Criteria (C/SCSC), and his support from the 1970's to his passing. I was also reminded of the visionary who actually created Earned Value and the need to document how and why it was created, how it morphed to the Air Force's Cost/Schedule Planning and Control Specification (C/SPCS), and then to C/SCSC. This is the story of those original efforts – the provenance, as the antique collectors like to say, of today's Earned Value Management System (EVMS).

Earned Value, as it was originally titled, was the creation of A. Ernest 'Ernie' Fitzgerald, a name well known inside the Beltway, but not so well known outside. Ernie was an Industrial Engineering graduate of the University of Alabama with an extensive knowledge of work measurement. He often stated that earned value is nothing more than classic work measurement. True, but it's like saying water is nothing more than hydrogen and oxygen. The work measurement components are traditional, but the context is unique, and it was Ernie who defined that context. That said, what led to it?

National Asset programs, such as the Navy's submarine-launched Polaris missile system, the Air Force's Minuteman Intercontinental Ballistic Missile system, the Apollo lunar mission, and the B-2 stealth bomber, are unique. They face the most daunting challenges, draw the greatest talent, get the most attention (much in secret), and cost by far the most. Unfortunately, they also typically have the largest overruns. That was the case with the Polaris and Minuteman programs of the 1950's and 60's.

The then-latest program management tool was the Program Evaluation and Review Technique (PERT). It was quite in vogue having been pioneered by Booz, Allen and Hamilton under a 1957/58 study contract for the U. S. Navy titled Program Evaluation Research Task (Project PERT).[1] While contributing some valuable new techniques, such as the critical path methodology, it was extremely burdensome because of the relatively modest computing power that was available at the time. As a result it was not always timely or reliable and was not widely used.

Around 1962, a joint Stanford/Navy team embarked on a project to expand PERT to include resources. Their thinking: if one could accurately simulate the logic of a project taking the form of a network, why not add resources into the network and manage both time and costs? The result was the introduction of PERT/Cost. It was ambitious in the extreme. Since neither the computer hardware nor the software programs of the time were available to properly support simple network scheduling, the addition of cost resources into the logic networks merely exacerbated the problem.[2]

The performance measurement baseline that was adopted for PERT/Cost was frequently updated estimates. The use of estimates was both the strength of PERT, and the weakness of PERT/Cost. There is a sharp distinction between the use of estimates, regardless of how detailed or often, and the use of a standards-based measurement baseline – the critical difference between PERT/Cost and Earned Value.

Recognizing that program performance measurement, and more importantly, Estimates at Completion (EACs), were not going to improve with the tools available, Ernie formed a consulting firm, Performance Technology Corporation (PTC), to address these and other

1 - D.G. Malcolm, J.H. Roseboom, C.E. Clark, Booz, Allen and Hamilton, Chicago, Illinois, and W. Fazar, Special Projects Office, U.S. Navy, Washington, D.C., Application of a Technique for Research and Development Program Evaluation, April 27, 1959.

2 - Quoted from: Fleming, Quentin W. and Joel M. Koppelman, Earned Value Project Management, Third Edition, Project Management Institute, Newtown Square, PA, 2005, page 28.

problems.[3] One of its first products was the seminal Earned Value Summary Guide, submitted in draft on February 25th and in final on April 30, 1965, in partial fulfillment of a contract with the Ballistic Systems Division (BSD), Air Force Systems Command (AFSC). The draft and final version of the Guide[4] contain a paragraph on page ix which states:

"Earned Value is a concept – the concept that an estimated value can be placed on all work to be performed, and once that work is accomplished that same estimated value can be considered to be "earned." The utility of this concept as a management tool is that the summation of all earned values for work accomplished when compared to what was actually expended to perform the effort can provide management with a comprehensible, objective indicator of how the total effort or any identifiable segment is progressing."

Shortly thereafter (March 21st) the first 'criteria' were presented to BSD. They consisted of 11 specifications/criteria and a checklist of 57 items to be used in determining whether the contractor's system was in compliance.[5] These specifications were added to the contracts of the eight Minuteman Associate Contractors, one of the largest national asset programs in DoD's history, and the implementation and validation of Earned Value began.

It is important to note that the early discussions of the Earned Value concept were based on the development of a specific system with well-defined characteristics; however, a survey of the aerospace and defense industry revealed that there was clear resistance to the implementation of a government-defined system. This, coupled with the fact that the contractors had long argued that their systems were the finest available to man, resulted in a rethinking of the approach.

The result was the so-called 'spec' or specification approach, wherein clearly defined criteria are established and the contractor's systems are audited to the criteria. Alternatively, each contractor could perform a self-assessment, with a government team confirming the results of the assessment through validation steps. The industry had so overextended its marketing efforts with respect to their management systems that it was virtually impossible for them to rebut the 'spec' approach. And so was born an approach that has continued for over forty years, and has seen widespread use in other areas, such as Material Management and Accounting Systems (MMAS) and Estimating Systems.

Concurrent with the introduction of Earned Value on the Minuteman Program, the Air Force began to consider the application of Earned Value to other major programs. Dr. Marks, Assistant Secretary of the Air Force, asked PTC to draft criteria based on the Minuteman Earned Value specs. In the Fall of 1965, under Ernie's supervision, Mert Tyrell and Dave Howard, with assistance from Phil Carter, drafted what became the C/SPCS criteria.[6] It was then forwarded for review and comment by a committee established to consider alternatives as well as various Air Force Staff officers. The reviews and coordination were facilitated when Mr. Fitzgerald was appointed Air Force Deputy Assistant Secretary for Financial Management in late 1965, with Dave Howard becoming the second president of PTC.

During this time the Air Force team and their consultants considered a number of recommendations from the industry and the military. One of the considerations was PERT/Cost. A PERT Coordinating Committee within the Air Force made a valiant attempt to substitute the PERT/Cost methodology for the Minuteman Earned Value methodology. The critical test was the basis for measurement and the projection of the EAC's. In the case of PERT/Cost the basis was frequently updated estimates, either by formula or individually at the work package level. Each month the baseline could be adjusted so that the sum of the actual costs and the estimate-to-complete would equal the original budget, masking overruns until the money ran out. It was the ultimate flexible baseline.

Earned Value, on the other hand, was based on standards derived from the subdivision of the contract, with change controls that limited any revision to the addition or deletion of specific work. It was a non-flexible baseline. The PERT/Cost methodology was rejected by the Air Force, and PERT/Cost gradually faded from the scene.

By mid-1966, it was clear that the Minuteman Earned Value approach would be the Air Force standard. The Minuteman Earned Value 11 criteria and 57 audit steps had been consolidated and restated into 35 criteria under the heading 'Cost/Schedule Planning and Control Specification' (C/SPCS). Of particular importance was the retention of the 'spec' approach that had been pioneered on the Minuteman program. Sufficient experience in this approach had been gathered by the Spring of 1966 to confirm its merits. C/SPCS was made official on August 1, 1966.[7] Unlike Minuteman, C/SPCS was not placed on existing contracts; new contracts with C/SPCS as a requirement began to appear in 1968. As might be expected, there was some industry concern expressed as to whether the Minuteman Earned Value and C/SPCS criteria were the same, and assurances were provided that they were.[8]

3 - PTC's prime years were 1965 –1968. During that time, under contract to DoD, the PTC team not only created Earned Value, but also the Contractor Funds Requirement Estimate (CFRE)/Contract Funds Status Report (CFSR), Should Cost and Design to Cost.

4- EARNED VALUE SUMMARY GUIDE, (draft copy) with transmittal letter signed by A. E. Fitzgerald, submitted to LtCol E.

5 - Earned Value General Specification and Checklist with transmittal letter signed by A. E. Fitzgerald, submitted to LtCol E. J. Mason, BSQL, Ballistic Systems Division, Norton Air Force Base, San Bernardino, California, March 21, 1965, in accordance with CCN #1 to Contract AF 04-(694)-682. J. Mason, BSQL, Ballistic Systems Division, Norton Air Force Base, San Bernardino, California, February 28, 1965, in accordance with CCN #1 to Contract AF 04-(694)-682.

6 - Author's conversation with A. Ernest Fitzgerald, September 18, 2009.

7 - Cost/Schedule Planning and Control System (CSPCS) with attached specification, transmitted to AFSC Divisions and Centers by Herbert L. Repetti, Deputy Director of Procurement, 1 August 1966.

Recognizing that the earned value approach had merit beyond the Air Force, Dr. Robert N. Anthony, Assistant Secretary of Defense (Comptroller), decided that it would be worthwhile to expand the Air Force C/SPCS to a DoD-wide requirement. Accordingly, a joint-service team was appointed to determine how best to meet that objective. The result was the December 22, 1967, issuance of Department of Defense Instruction (DoDI) 7000.2, Performance Measurement for Selected Acquisitions. This document did not contain criteria, specifications, or checklists; its purpose was to set the policy for performance measurement throughout DoD.

DoDI 7000,2 stated that the use of Cost/Schedule Control Systems Criteria (C/SCSC) was required, but did not define, describe or state the criteria; however, paragraph VI stated that a Guide for Performance Measurement would be distributed separately from the Instruction. A Coordination Draft of the Guide was published on June 28, 1968,[9] but it was neither user-friendly nor definitive. It, in turn, was followed by the C/SCSC Joint Implementation Procedures, transmitted on September 10, 1970.[10] Finally, a true C/SCSC Joint Implementation Guide, signed by each of the General officers of the appropriate commands, in the format most of us would recognize today, was published on January 27, 1972[11].

The long gestation period for C/SCSC did not have a noticeable impact on the original Minuteman Earned Value or USAF C/SPCS criteria or the validation process, but it did result in changes to key terms that resulted in practitioners and executives becoming confused, a condition that continues to the present day. It also resulted in implementation delay; contracts with C/SCSC as a requirement did not emerge until the early 1970's.

The thirty-five criteria that were defined in the early 1970's have led to the development of a number of improved techniques for the monitoring of project performance, the most important being the introduction of the Integrated Baseline Review (IBR) in 1994. It must be remembered that while performance measurement is the critical structural component of Earned Value, it was not created for that purpose alone. At the time (1965) Estimates at Completion (EAC's) were notoriously inaccurate. Finding a solution to that problem was the primary objective of Earned Value and the reason for its support by first the Air Force and then the Department of Defense.

Throughout the development described above, there were some interesting and colorful attempts to simplify the systems demonstration/validation process. One of the most interesting was the clamor for a 'Good Housekeeping Seal of Approval.' During the early 20th Century, a major periodical, Good Housekeeping, underwrote the testing of hundreds, perhaps thousands, of products that could be used in the average household. If the product was safe and performed as claimed it could get the 'Good Housekeeping Seal of Approval.' Good Housekeeping established such a reputation for quality testing that the term gained widespread use. So it wasn't a big surprise when industry and suppliers of software started calling for a 'Good Housekeeping Seal of Approval' for C/SPCS and C/SCSC 'products.'

The most energetic effort was that expended by IBM. They identified a market for software that would facilitate compliance as a worthwhile endeavor. The key was getting DoD to agree that if a company purchased and installed their software there would be an automatic approval of the contractor's compliance with the spec. Towards that end IBM was willing to set up a test scenario wherein audit teams could test the software to prove that it worked, and from that was expected the 'Seal of Approval.' A significant lobbying effort was launched to obtain that objective.

For awhile there was evidence that the campaign was getting some traction, but in the end, senior executives at DoD made it clear that there would be no 'Seal of Approval' for any commercial product. The problem is that a 'product approval' approach would completely ignore the fact that compliance was not based on a software package, as an example, but was based on the combination of policies, procedures, systems, practices, and most important, meaningful use of the data that demonstrates effective implementation. That is as true today as it was 40 years ago.

The evolution of C/SCSC and subsequently EVMS, and the role of the men that ensured that they retained the original standards-based methodology, is beyond the scope of this article. Suffice to say that without the efforts of Larry Stone, Bob Kemps, Dick Garretson, Gary Christle, Wayne Abba, and, of course, Hans 'Whitey' Driessnack, along with those outside of the government, such as Gary Humphreys, and others too numerous to mention, we would not have a tool that, when effectively used by the customer and the contractors, can realistically solve the still lingering problem of inadequate and inaccurate EACs.

8- Development of Performance Measurement Systems Demonstration Procedures, letter to the Deputy Assistant Secretary of Defense from Dr. Hans Marks, Jr., Asst. Secretary of the Air Force, 29 December 1966.

9 - Department of Defense GUIDE FOR PERFORMANCE MEASUREMENT, Coordination DRAFT, Office of the Secretary of Defense, Washington, D.C., June 28, 1968.

10 - MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS, Performance Measurement for Selected Acquisitions, transmitted by David Packard, Deputy Secretary of Defense, Sep 10 1970.

11 - MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS, Performance Measurement for Selected Acquisitions, transmitted by Melvin Laird, Secretary of Defense, Jan 27 1972.