

Earned Value Management

From Government Contracts to the Project Management Universe

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Earned Value Management originated in the 1960s as a technique to manage large contracts in the United States Department of Defense. Over many years and many hundreds of contracts, EVM proved its value as the best way to measure progress in achieving contract objectives and to estimate the cost at completion. EVM now is mandatory for all United States government agencies. Their budget requests must include strong business cases exhibiting effective use of EVM, both for government and contractor effort.

This paper traces EVM from its government origins and explains its increasing acceptance worldwide as the tool of choice for **integrating work scope with schedule and technical performance metrics** in project-based enterprises. Beyond government, EVM is gaining acceptance for projects of all sizes, due to several factors. First, the US government and its contractors developed an American National Standards Institute (ANSI) standard for EVM. Issued in 1998, ANSI/EIA 748 has replaced government regulations and is being adopted by companies in various industries. Second, inexpensive project management software has made EVM accessible to projects of any size. Third, the Project Management Institute has embraced EVM and published an EVM practice standard.

These influences – government leadership, technological innovation and advocacy by industrial and professional associations – are converging to make EVM the **preferred model for integrated project management**. Whether in government or industry, managers can use EVM to measure progress on the projects in their portfolios objectively, to quantify risk and to make informed decisions in the best interests of their project stakeholders.

Introduction

This paper discusses the author's experience in a large project management organization – the United States Department of Defense, where he served from 1982 until 1999 as the senior contract performance analyst in the Office of the Secretary of Defense. He developed management policy and analyzed contractor performance for a wide variety of products including airplanes, ships, land vehicles, software, spacecraft, electronics and weapons.

It is useful to understand that experience because management concepts being embraced worldwide originated in DoD, evolved during the author's public service career and continue to grow under the leadership of industrial and professional associations. Despite the differences between government and commercial business, the same basic principles apply to the management of all projects.

The contracts were for research and development and production, for total systems and subsystems such as aircraft engines, for entirely new systems and improvement of old ones – in short, the entire range of defense acquisition.

The DoD sought constantly to improve project management. When mistakes happened, DoD learned from them and moved forward. As its knowledge base grew, DoD shared information with researchers in government and academia to understand the trends and to improve management.

The Department meets its management challenges by relying on project management and a strong industrial base. The Department and its contractors originated many of the concepts that are used in modern project management. In a sense, DoD and defense industry comprise a huge project management "laboratory" where new ideas are tested. Those that work stand the test of time; those that fail go into the trash bin.

Integrated Project Management

The story begins in the 1960s, when Defense projects often produced unsatisfactory results. Late delivery and cost overruns were common.

New management techniques such as the Program Evaluation and Review Technique, or PERT and PERT COST were developed to solve the problems posed by increasingly complex projects. By 1964 the Army, Navy and Air Force had developed about ten different versions.¹ That complicated business for defense contractors because each new contract brought with it a new requirement that specified how the contractor would manage the work.

Department managers studied how the best American companies managed projects. They observed how Boeing, Lockheed, Martin Marietta and others organized, planned, budgeted, scheduled, executed and reported their projects, captured the essential elements and in 1967 put them in defense regulations not as specific instructions, but rather as statements that defined the essential features of an effective management con-

trol system.²

The central concept was “Earned Value Management” or EVM, an extremely powerful management technique that took project management to a new level. Until then, project managers focused mainly on technical performance and schedule.

Before EVM came into existence, cost performance on contracts was measured simply by comparing the funds planned to be spent at any point in time with actual cost expenditures. That’s called “spend plan” analysis and has a serious deficiency: it cannot provide an objective measure of how much work was completed in comparison with the plan.

With EVM, contractors were required to integrate their project work, schedules and cost in a single plan. As they performed the contract, they could measure progress on any of those parameters, use the information to report more accurate status to internal management and customers, and estimate reliably the time and money needed to complete the contract.

The Department issued procedures for reviewing and approving contractor management systems. The contractor could then use the approved system for contracts from any Army, Navy or Air Force customer. This new philosophy was a big step forward and the contractor reports created a knowledge base in the Pentagon that would prove invaluable in later years.

Management and Reporting Problems

Earned Value Management became defense policy in 1967. In 1982 the author joined the Office of the Secretary of Defense., where for the next seventeen years he reviewed contractor reports from the Army, the Navy and the Air Force, prepared analyses for senior Pentagon leaders, and developed new management policy.

He quickly discovered that EVM was not working as desired. Air Force aerospace contractors were providing good information, but Navy shipbuilding contractors were not. Ship programs were in the news regularly with embarrassingly accurate stories of mismanagement.

He spent much time in the 1980s evaluating the shipyard management systems and correcting the problems. When DoD completed its improvement efforts, ship production was more efficient, management systems had been brought up to aerospace standards and the performance reports were much better.

The A-12 Fiasco

In the late 1980s, two events affected project management in important ways. First, in 1989 the DoD EVM

office was transferred from the financial organization to acquisition, placing it closer to the decision makers. New leaders were happy to have the proven EVM capability available directly to them. Second, incoming officials in the George H.W. Bush administration asked the EVM office to analyze performance on a top secret program, the Navy A-12 Avenger II stealth bomber.

The A-12 program was so sensitive that its very existence was not acknowledged. But with just one look at the earned value information, EVM specialists in the Pentagon realized the program was a disaster. The analysis report moved up the management chain very quickly to the Secretary of Defense.

The analysis showed that the two contractors, General Dynamics and McDonnell Douglas, were in danger of losing at least a billion dollars on the contract. If the design and manufacturing problems could not be solved, the contractors would lose even more money – and there was no assurance the problems could be solved.

A Navy investigation revealed that the A-12 program contractors were not using their earned value information effectively. By the end of 1990 it was clear that the program was a disaster.³

The Defense Secretary declared “This program cannot be sustained unless I ask Congress for more money and bail the contractors out. But I have made the decision that I will not do that. No one can tell me exactly how much more it will cost to keep this program going. And I do not believe a bailout is in the national interest. If we cannot spend the taxpayers’ money wisely, we will not spend it.”⁴

The contract was terminated for default, meaning the contractors were required to repay the government more than a billion dollars. They did not agree and sued for relief in the United States Federal Court.

The A-12 is the largest contract termination case in history. The litigation that began more than a decade ago is not finished, despite five trials that produced more than sixty million documents. The contractors won every decision in the first four trials. However, the judge would not admit into evidence testimony about the earned value information.

When a higher court decided that the termination was based on contractor performance and overruled the judge, he finally heard the EVM testimony in 2001.⁵ In August of that year he reversed his previous judgments and found in favor of the government.

As it stands today, the contractors owe the government some \$2.5 Billion in cash including accrued interest, which continues to grow by more than \$200,000/day while legal appeals frustrate a final settlement.

One thing is clear – this case should not have gone to trial. The courthouse is the wrong place for project management. Earned value data showed the contract status plainly and should have led to a negotiated conclusion. Whoever wins in the end, the taxpayers will have lost millions of dollars in legal fees.

It is difficult to change the culture in any bureaucracy – if indeed one can “change culture” at all. But it is possible to change behavior, especially when the catalyst for change is a crisis or a failure on the scale of the A-12. Industry and military careers and reputations were damaged and the Navy suffered as its aging airplanes became more expensive to operate.

On the positive side, the A-12 fiasco prompted immediate changes as the Navy and its contractors took steps to improve project management. For the aircraft program that replaced the A-12, the F/A-18E/F Super Hornet, they put responsibility for performance management – earned value – into the hands of the engineering and manufacturing teams, who used it weekly to maintain control.

The Super Hornet development contract was awarded to McDonnell Douglas for \$3.4 Billion. It was completed on time and within budget while meeting its performance requirements.

The Boeing Company acquired McDonnell Douglas a few years ago. Since then, managers on programs like the Super Hornet have risen to senior positions and have adopted EVM for Boeing’s commercial business lines, having learned that EVM can be used on projects of any size, scaled using the same basic principles and tools.

International Interest in EVM

Failure and crisis stimulate behavior change in bureaucracies. Unfortunately, that seems to be true everywhere. At the same time as the US DoD was discovering management and reporting problems on the A-12 and other programs, counterparts in other countries were experiencing similar difficulties.

First Australia and then Canada sent representatives to the Pentagon in search of better management techniques. In Australia, the search was required by a Parliamentary Committee of Inquiry after some serious cost blowouts on an Australian Navy ship program and on construction of the new Parliament House. In Canada, the search was prompted by the Treasury Board Secretariat when problems arose in government information technology programs.

In 1995, the three countries executed a memorandum pledging to recognize contractor management systems accepted by any of the countries. When Sweden and the United Kingdom took note of these developments and

began using EVM, the countries created the International Performance Management Council as a forum to exchange information.⁶ Through cooperation a foundation of mutual trust and respect has been built, not only among the governments but also among their contractors.

The Role of Government

In any country, government provides funding for capital projects such as roads, bridges, national defense, information technology, and so on. It also provides the legal framework for government acquisition and management. Thus, governments exercise enormous influence through spending and regulation. But governments come and go through political changes and may not have the long term view that is needed to improve project management in large organizations.

Having established its reputation, the DoD EVM office enjoyed support from leaders in each new administration, even ones with reform agendas. The National Performance Review and defense acquisition reform initiatives in the Clinton administration were the most far-reaching in the author’s experience.

At a stroke of his pen, President Clinton’s Secretary of Defense cancelled thousands of military standards and other regulations. The choice for the bureaucracy was clear – change the way you do business or go out of business. In the end, DoD leaders reaffirmed EVM and embraced it as part of defense acquisition reform.

Those leaders also encouraged international and interagency cooperation. With their approval, DoD reached out to other government organizations, especially NASA. At one time NASA had its own unique contract management requirements although it awarded contracts to companies that also had defense contracts.

During the 1990s DoD and NASA brought their policies into alignment. However, other government agencies such as the Department of Transportation and the Department of Energy either ignored EVM or did not take it very seriously.

As the 20th century drew to a close, the Office of Management and Budget in the Executive Office of the President extended to all federal agencies the same EVM management concepts used by Defense and NASA. The OMB also required the agencies to report earned value status once a year during the budget development process. Each year since, OMB has continued to refine the requirements and has both penalized and rewarded agencies based on the quality of their business cases and EVM implementation.⁷

The Role of Industry

When the author began his work at the Office of the Secretary of Defense, the government-industry rela-

tionship was adversarial. The more he learned about the reasons for the tension, the more he realized that industry complaints were justified. Government contracts required too much detail and intruded too far into industrial management practices.

Defense officials struggled with those issues and debated how much flexibility government should allow industry. In 1995, DoD suggested to the National Defense Industrial Association that it should undertake a transfer of responsibility for industrial management processes from government to industry. NDIA accepted the challenge.

When the first draft was ready, NDIA sent a copy to DoD for comments. Because it looked very much like DoD EVM regulation, defense officials worried that NDIA might have written the document to satisfy the perceived interests of its main customer.

At DoD's request, NDIA invited other industry and professional associations to participate, then reassured DoD that the document reflected their views. As a result, the American National Standards Institute issued the world's first integrated project management standard in 1998.⁸ In 1999, DoD incorporated the standard in its acquisition regulations. This marked an important step in the transfer of responsibility for industrial management standards from government regulation to industry.

In 2002, OMB took the next step. It required all government agencies and their contractors to use the ANSI standard as the basis for project management and reporting. When agencies submit their budget proposals to OMB, they must provide strong business cases for their capital investments, supported by a project management plan based on the ANSI standard.

In this way, government reform efforts begun in DoD are now fully defined in an ANSI standard and put all government agencies on equal footing in terms of management expectations. Agencies are expected to achieve 90% of cost, schedule and performance goals and must report to OMB annually, including their contractors' EVM data.

The 1990s witnessed arguably the largest industry shakeout in history as the US aerospace industry shrank from 26 contractors to four. The survivors, Boeing, Lockheed Martin, Northrop Grumman and Raytheon, are using the EVM standard to define their enterprise management systems.

As they incorporate EVM for commercial lines of business, defense companies are discovering that it makes sense not only for large government contracts, but also for small projects and internally-funded projects.

It is very difficult for individual companies to talk candidly to their customers about management issues.

However, there is safety in numbers. DoD encouraged open communications channels to industry through NDIA. When issues arise, they are discussed in open forum and both sides provide members to joint working teams to develop solutions.

The Role of Professional Associations

Professional associations are very important in project management. For many years the only association interested in EVM was a small organization called the Performance Management Association. In the late 1990s PMA discovered the Project Management Institute and decided to merge its 800 members with PMI's 35,000 as the PMI College of Performance Management. In 2005 PMI published the Practice Standard for Earned Value Management, making this management technique accessible to some 250,000 PMI members worldwide.⁹

International Trends

Australia has more than ten years of successful experience with EVM as a government regulation. Canada also has been using EVM more than ten years and has adopted the ANSI standard because Canada and the USA are close trading partners.

Sweden and the United Kingdom began looking seriously at EVM more recently, in the late 1990s. In both countries, early experiments were successful and EVM is being adopted more widely. The UK is emerging as a world leader, as EVM is used by commercial construction companies and as part of the Ministry of Defense's "Smart Procurement" initiatives. The UK Association of Project Management produced a CD titled "Earned Value Management: APM Guideline for the UK" that is recognized by NDIA as philosophically equivalent to the ANSI standard.

Project Management in Transition

The American experience with EVM has repeated itself in other countries. The direction of movement usually is from government to industry. Along the way, typical issues arise:

- Should government or industry assume the leading role? Usually it is government, but progress cannot happen without cooperation from industry.
- How difficult will it be to implement this new management approach? It will not be easy, but nothing of value ever is.

The Future of EVM

Where will EVM go in the future? These predictions are not really speculative; all are happening today in advanced organizations, but it will take some time for them to become the norm.

Perhaps the most important trend is the growing relationship between project management and an organization's business objectives. Governments demand a strong business case supported by a sound project execution plan. Industry demands better results on the bottom line.

Better management systems integration makes it easier for common project management techniques to be used for smaller, less complex projects. An enterprise management system can be constructed that does not require all projects to be managed exactly the same way, yet all can be managed and measured consistently.

The demand for enterprise tools leads to more effective project management software. Tools once used at the high end are being adapted for wider application and tools used at the low end are becoming more sophisticated, thus providing more value and capability across the spectrum.

Of course, change on such a vast scale is not easy. But just because change presents a challenge does not mean it should not be undertaken. Counterparts in Australia, Canada, the United Kingdom and the United States have been through similar evolutions. Their representatives at international forums are candid and open. They describe successes and challenges, recognizing that both kinds of experiences must be shared if we are to advance project management knowledge.

As you ponder such questions, it is useful to keep in mind an essential difference between government and commercial management. If a company makes a fatally flawed or unethical decision, its responsibility ends with its owners. A company may in fact go out of business – ENRON and WorldCom may come to mind.

Government cannot operate the same way. It must deliver security and services to its citizens. When it fails, the pain is felt in the purse of every taxpayer and business organization. The public rightfully expects its government to operate with the highest ethics and to employ the best management techniques possible. Earned value based project management is the world standard.

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6. The author drafted and negotiated on behalf of the US Department of Defense the Memorandum of Agreement with the defense organizations of Australia and Canada and served as the first chair of the International Performance Management Council.
7. See www.whitehouse.gov/omb/.
8. ANSI Standard EIA-748 is available through the American National Standards Institute webstore, <http://webstore.ansi.org/>.
9. The PMI Practice Standard for Earned Value Management is available at the Project Management Institute website, www.pmi.org.

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