White Paper
Earned Value Management - An Analytical Approach

What is Earned Value Management?
Earned Value Management (EVM) is a method of projecting cost or schedule overruns in a large project. It primarily defines a working relationship between the Federal government and its contractors. Many elements are involved and will be detailed later, but generally include task definition, appropriate communication pathways, cost projections, and comparisons between the actual and projected cost of a project. Thus, two sets of values are created; one firm set prior to project initiation and one fluid set based on the real costs of meeting tasks and objectives. EVM is a form of comparative analysis between the two throughout the life of the project.

With baseline values fixed prior to starting a project, the technique can locate deviations in project progress early, while they are small, before the cost to correct them becomes overwhelming. Earned Value Management can also be referred to as a cost/schedule control system (C/SCC). Early agreement on the EVM methodology, objectives and criteria is critical for projects that may last for many years. The main objective is always to contain cost, save money if at all possible, and locate early warning signs of deviation from the planned timeline of the project.

EVM is not a process, it is a system of criteria applied to baseline values and actual costs alike. No system can be used for more than one project - each is unique.

Technique
Cost and schedule are closely bound in EVM - each one drives the other and the completion of the whole project. Within EVM the two can be fully interrelated while maintaining distinct influences in contributing to project completion. One cannot vary from the project plan without affecting the other, thus this technique can spot changes in project progress even before monthly reports are filed.

Resources
EVM relates resources to schedules and cost and resource requirements. One central aspect of EVM is that resources are allocated early in the project to meet all the project requirements. This planning process assures that necessary production or maintenance resources are set aside in advance. The alternative involves provisioning a project on a Just-in-Time (JIT) basis. It may be cheaper but is riskier in assuring a scheduled outcome. In the newest mid-west USA Jeep plant not one item is stored; every spare part for every vehicle is brought to the plant at the exact hour set on the production plan. While this may be an economical necessity for mass production; it is a risky strategy for projects with a

Universal Application
There is a wide variety of variations in organizations, products, and working relationships in Federal government vendors. It is not feasible to place an identical system on all contractors for contracts of all sizes and types. The only universal requirement is that management recognizes the need for a system and implements it to assure total integration of cost, schedule, and technical aspects of contracts.

Ultimate Goals
Two goals drive all Earned Value Management efforts: effective cost control and objective and reliable data for the customer.

Example
Assume that a task placed midway in a project plan was projected to cost $65.00, but actually cost $91.00 to complete. The difference is $26.00, a variation of -40%. The process of Earned Value Management is simply monitoring a series (occasionally a very long series) of these calculations progressively during completion of a project. The system can be used to monitor schedule variances and predict long term variances from the projected baseline. It is easier to correct a small variation early than move the whole project later to fix a larger error.

Criteria
Earned Value Management criteria are used to demonstrate that the balance between cost and schedule systems is acceptable for a large risky project. Systems must be general in nature to allow flexibility in project completion and the widest application for a variety of projects. EVM has its strongest application in development, construction, and production contracts. Detailed sequences here are often difficult to specify. The criteria used must be based on common sense and practicality. The following criteria must apply to any selected system:

Organization
Organizational structure influences every aspect of project completion from the manner in which work elements are defined to the organization chart for the project to planning tasks to allocating resources to meet the project requirements. Organizational structure will vary between a three person engineering firm and a large international defense contractor. Work breakdown structures keyed to the organization facilitate task evaluation and management.

Planning and Budgeting
Planning and scheduling processes describe the sequence of work and allocate resources to meet task completion requirements. Planners and schedulers set milestones for completion of defined portions of the necessary work. A list of milestones constitutes a

single outcome.

Responsibility
Responsibility for EVM implementation and all project outcomes rests with the contractor - the contractor must set up the EVM system to be used with government oversight. Any system is subject to government acceptance by one of three methods - set up a system with government involvement, third party validation or straight government approval. The critical aspect is to reach agreement on the technique and follow through to the very end. Both sides are bound by the criteria and systems set up in the planning stages.

System Requirements
Flexibility exists under the criteria. As indicated, every project is different, therefore each needs a unique application of the criteria for EVM - a simple file card system may suffice for manufacturing of ropes, while a sophisticated mainframe-based system may be needed for a worldwide military application.
System selection is a matter of choice. Each contractor has the choice of system, with approval of the customer and within the criteria; simplicity and effectiveness win out every time. Such systems are easier to understand and are less error-prone than more complex scenarios; but the system must be equal to the task; there is no room for compromise. Dedicated software packages provide a wealth of tools for such purposes.

time phased budget baseline with a budget for authorized work.

Accounting
Accounting allows project planners and monitors to compare costs to budgets and formally integrate costs to work breakdown structures. The work breakdown structures can be compared to tasks with cost, expenses, and schedules attached to each.

Analysis and Management
Most projects are reviewed and analyzed on a monthly basis. Analysis compares planned budgets to the amount of budget earned for schedule variance calculation. Some vendor products allow for reporting of cost and labor distribution values at any point in the project plan, offering a distinct advantage in monitoring the project.

Revisions and Data Maintenance
Incorporating changes in a timely manner based on analysis and documenting the changes serves to bring a project back on track and maintain essential information about project progress. It is only by taking action early, immediately on variance discovery, that a project is steered to a cost and time effective conclusion.

Variance

No project utilizing Earned Value Management is undertaken without development of the baseline plan along with a series of tools to measure performance and accomplishments by objective criteria. The baseline defines the tasks necessary to complete the project and defines support resources necessary to complete the tasks. Utilizing objective criteria in task definition enables precise forecasts. Analysis of the variances from a plan supports decision making; and defines action plans. The baseline specifies in detail the anticipated cost of completing each task of a project.

Variance Analysis
Variance analysis consists of consistently comparing the cost of project tasks against the baseline developed for the project. Analyzing the variance identifies deviation from the expected costs, permitting correction and returns the project to the expected results.

Insights gained from examining relationships between the various forms of information available through xpdoffice™ is very easy to use, yet its maintenance of a record of every transaction within the system supports instant development of an audit trail, vital in support of an EVM initiative. A few mouse clicks produce records from last week or five years ago. Preparation for an audit of any kind is vastly simplified. And the same information can be retrieved repeatedly, on demand. Information entered into xpdoffice™ in its standard operating mode can be easily and rapidly retrieved at any time, and reported in standard or custom formats. xpdoffice™ can thus serve as a vast (and organized) electronic filing cabinet, saving valuable storage space. With real-time reporting capabilities, an organization can monitor its activity at any point in time. That information supports adjustments in keeping a process under statistical control. xpdoffice™ is so simple to use, it quickly integrates into any EVM system established based on DoD 5000.2R Appendix VI, and becomes a vital component in project completion efforts.

Elements designed directly into xpdoffice™ : reduced duplication, paperless transactions, and reporting to outside analysis applications, support efficiency in operations.

About xpdientinc - Corporate Overview

xpdient Inc., a division of Scientific Systems and Software International Corporation, is offering xpdoffice™ , an integrated package of web-based

xpdoffice™ reporting functions point to cost savings and increased efficiency in resource allocation.

Monitoring Schedule and Cost
Schedules and costs can be monitored simultaneously through Earned Value Management or independently. No other technique enables a project planner to do this. Numerous software packages are available to assist with this effort. Information related to one example is printed on the next page.

Critical Ratios

Project managers calculate various ratios at designated points in the project. One ratio combines schedule progress versus actual progress with the budgeted cost versus the actual cost, as illustrated below:

Actual Progress/Scheduled Progress X Budgeted Costs/Actual Costs

This ratio serves a useful diagnostic tool for the general health of a project as it combines schedule and cost in that a poor performance in one can be compensated for by a good performance in the other. When control limits are combined with the ratios additional insight is gained into project progress.

Productivity and xpdoffice™

Earned Value Management has become an integral part of business activity and production plans between the private and public sectors. Four facets of integrating xpdoffice™ into the overall production or productivity scheme of an organization support EVM plans and initiatives, within its sphere of capability. The facets become benefits because xpdoffice™ works with you in support of an organization's current production and quality objectives. EVM support elements of xpdoffice™ include: introduction of a simple application with a high-end result, easy retrieval of necessary process information, the capability of making adjustments in real-time, and direct integration as an enterprise system.

software products that simplify business processes in a variety of environments. Advantages of these products consist of enhanced resource management, high performance/mobile workforce support, and better use of an existing infrastructure. Designed to operate in a wide spectrum of private sector industries and public agencies, xpdient Inc. products offer a solution for you. Communication and time management are essential elements in assuring attainment of performance goals. Our software packages provide customers with accurate timesheet and status reporting, total web site content management, professional Intranet deployment, and web-based training, among others. SSSI's foundation products, xpdtime TM , webZerve TM and intraready TM support all of these efforts, and integrate them seamlessly into any project plan. Our application service provider model is risk-and maintenance-free.

Our customers range from departments of the Federal Government to businesses. Our staff provides each customer with the same attention to detail, assuring fulfillment of its objectives. Through use of our products, they are experiencing reductions in waste and duplication, increased accuracy in information reporting, and have a better understanding of the financial and operating health of their organization. In short, improved profitability and productivity are attained.

xpdient Inc. is comprised of highly qualified and experienced professionals in technical, organizational development, training and solutions competencies. Our observations prove that a workforce that can analyze its activity can focus its performance.