

# CONCERNS OF PROJECT MANAGERS

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## This & That EARNED VALUE: Sound Basis for Revenue Recognition

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Revenue recognition for non-repetitive efforts, such as projects, is an ongoing concern for project managers, the accounting profession and investors. A project is: "Any undertaking with a defined starting point and defined [project] objectives by which completion is identified [1]." Typical projects include: construction of plants and facilities, development of a software program, production of a movie, creation of an advertising campaign, and so on.

For the software industry, the American Institute of Certified Public Accountants (AICPA) has proposed a Statement of Position (SOP) under the direction of the Securities and Exchange Commission [2]. This was issued to satisfy the investment community's request for greater consistency and predictability. The essence of this position paper would bring the software industry into similar practices as the construction industry by allowing revenue and profit recognition based on project percent complete.

The basic accounting problem with large projects, is that they take more time to complete than some inter-

ested parties are willing to wait before recognizing revenues for the effort. When a company assesses its financial status, it must have a method for measuring the revenues for its efforts. When a project takes several months or years, it is necessary to find a measurement method that will recognize revenues at more frequent intervals than project completion.

The following discusses the problem and a proven solution for reporting the status of projects. This solution satisfies the requirements of the accounting and investment communities and is standard project management practice.

### CURRENT PRACTICES

AICPA policy guides current practices by providing that revenue is typically recognized at the completion of a contract except in cases where the contract may extend for long periods [3, p. 268]. The exception makes allowances for efforts that take a long time while providing for more frequent recognition of revenues and profits. To make the exception workable, the percentage of completion of the project ("progress-to-comple-

tion") is often used as a measure for recognizing revenues.

The AICPA expresses its concern for determining the best approximation of progress-to-completion in the draft SOP for Software Revenue Recognition. "Value-added output measures often would provide the best approximation of progress-to-completion, but little has been written about how to apply such measures. Conceptually value is added to a contract at every step of performance. However, in order for the value added to be verifiable, contractual elements or subcomponents of those elements must be identified [4, par. 88]." In effect, what the AICPA is saying here, is that, for long projects, a reliable determination of progress-to-completion (or percent complete) would be beneficial for establishing a basis for revenue recognition. The AICPA also states that there does not seem to be a wealth of published information regarding how to establish a good value-added formula for determining the progress-to-completion of a project. And yet, some approximation of percent complete is made.

## PERCENT COMPLETE

The common practice of using percent complete as a measure of revenues to be recognized is certainly acceptable. However, here we face a dilemma. How does one define or calculate the percent complete for a project made up of many activities? Projects are generally unique, one-of-a-kind endeavors with little or no historical data to use for estimating the project status. Furthermore, projects are usually made up of many different kinds of activities, unlike manufacturing processes with similar, repetitive activities. This does not allow simple calculation of a combined percent complete.

Coombs and Palmer give three methods for calculating percent complete of a project: the cost-to-cost method, the efforts-expended method and the physical observation method [3, pp. 277-280]. These methods are generally accepted by the accounting profession. The cost-to-cost method calculates the earned revenues as:

$$\text{Revenues} = \text{Contract Price} \times \frac{\text{Actual Cost To-date}}{\text{Total Cost}}$$

This assumes, of course, that physical progress was achieved merely as a result of expending costs. The performance of the supplier does not factor into the equation. This means that a supplier who is working at a low level of productivity will receive his revenues at a greater speed than the purchaser is receiving value and functionality. The converse is also true. Therefore, unless the work is progressing exactly on target with regard to cost and schedule, one party or the other is likely to be unhappy.

The efforts-expended method is similar to the cost-to-cost method except that labor hours are used as a unit of measure. This is common practice on labor-intensive projects. The problems inherent in the cost-to-cost method exist here as well.

The physical observation method simply calculates the percent complete of the various portions of the project by counting the installed quantities and dividing by the total quantities expected to be installed. This works great in a physical construction project but still needs a weighting method to facilitate calculating a combined percent complete.

This method is difficult, if not impossible, to apply on projects such as engineering and design, development of a software program, creation of an advertising campaign or production of a movie. The activities are just too varied and do not lend themselves to counting physical output. For example, how do you calculate a combined percent complete for a design effort that involves drawings, specifications, procurement, calculations and studies?

Consider the simplest project with one of each of these activities. If the calculation, specification and study are complete, the drawing is half done and the procurement has not started yet, how complete is the project? Even for physical construction, if 300 yards of concrete have been poured, 60 tons of steel erected and 150 feet of pipe installed, how complete is the project? For software development, how do you combine progress on coding with progress on debugging or documentation? It's not easy to compare apples with oranges. Some means of weighting the components of the project is needed.

## THE SOLUTION: Earned Value

A uniform method of measurement is needed to come up with an objective measure of the percent complete of a project. Earned value is a method developed for this specific problem. It was formally defined and implemented by the U.S. Departments of Defense and Energy for uniform contract reporting on government contracts [5]. Since then, numerous private firms have adopted the concept of earned value for monitoring their own projects and for reporting to management the status and condition of all projects on a uniform basis. The driving force has been the desire of company management to know truly how their work-in-progress is proceeding. While this in-house review is very effective, it is also easy to use the same information to report project progress to their clients.

The purpose behind earned value is to provide a uniform measure of project progress and performance. As used herein, progress refers to the schedule-related issues and performance refers to the cost-related issues

of a project. Whether the purchaser or the supplier, or both, are interested in progress or performance usually depends on the kind of contract between the parties. For example, if the contract is a fixed price contract, then the purchaser is not too interested in the actual costs incurred by the supplier, but the supplier is very interested in the cost performance. However, the accounting and investment communities are very interested in the progress part of the project status. As pointed out above, the challenge is to find a meaningful measure of project percent complete, or progress-to-completion, for revenue recognition.

## The Concept

Earned value is a method of calculating project percent complete with a uniform unit of measure for all project work. The most frequently used units of measure are cost in dollars and labor in hours. To get the full picture that includes subcontracts, materials, tools, supplies, burdens, overhead and other related costs, one must use dollars. Some items, such as the cost of renting a crane, are not easily expressed in labor hours, yet are very much a part of the cost of the project and contribute directly to the total price. On the other hand, for simplicity, many firms use labor hours as the unit of measure on labor intensive projects. This is justified when most of the cost of a project is expressible in terms of labor hours. This decision is left to the individual applications.

The concept of earned value is quite simple. The application is simplified by computer programs that perform the calculations and print the reports and graphic output. The definition of earned value speaks for itself. It is defined as the Budgeted Cost of Work Performed (BCWP). This means that it is the budget that had been allocated to the work that was actually accomplished. The assumption is made that every component of the project is covered by some part of the budget.

Earned value is effective because progress is measured in units (dollars or hours) that were allocated at the beginning of the project. Subsequent progress reporting and earning of credit are very objective and unarbitrary, as

presented below. While the accuracy of the budget allocation maybe questionable, experience indicates that a reasonable guess of the budget allocation by experienced team members provides acceptable results.

By measuring the budgeted cost of the completed work and comparing it with the budgeted cost of the total project, it is possible to determine what percentage of the project was completed. For the investment community this answers the basic question of how much revenue can be recognized at any point in time. For accounting, project and company management, earned value provides significantly more information. In addition to establishing a percent complete for the whole project, earned value provides a basis for analyzing the speed of progress and the cost performance of the various components. This is described further under The Result, below.

### The Application Setting

To understand the validity of earned value as a basis for revenue recognition, we must take a look at the application of the concept. The process of setting up an earned value system consists of three basic steps: (1) define the total scope of the project; (2) prepare a schedule of activities; and (3) allocate the entire budget to the activities. The scope is defined by listing the deliverable items a project produces. For a construction project this would include the installation of concrete, steel, piping, equipment, wiring, etc. For a design effort this would include each drawing, specification, formal calculation, study and procurement effort. For a software development project this would include the code for each program segment or module, documentation, major test program, integration and delivery. To provide a means for organized reporting at detailed levels (below total project), the work is organized into a work breakdown structure (WBS). This groups related activities into subcomponents of the project. It provides the basis for reporting progress and performance at higher levels of summary. For a design effort, this might mean that the activities for all drawings for the cooling water system are grouped to-

gether, as are those for the fuel system, the foundation system, the lighting systems, etc. For a software development project for a Supervisory Control And Data Acquisition (SCADA) system this might mean that all activities for the data acquisition code are grouped together, as are those for the operator interface, the historical data handling, the report generation, the power flow calculations, etc.

The schedule of activities is typically prepared on a computer using a Critical Path Method (CPM) scheduling program. The level of detail used to schedule the work depends mostly on the degree of control desired and the frequency of reporting progress on the schedule. Experience, that schedules are most effective if the duration of activities does not exceed three update cycles. If the update cycle is monthly, then the longest activity should be three months. Similarly, if the update cycle is weekly, then the longest activity should be three weeks. Of course, some exceptions to this criterion may be necessary, it has proven to result in reasonable progress being reported at each update cycle.

The budget allocation should be done at the schedule activity level of detail. By allocating the budgets to the activities, there is an automatic time phasing of the expected cash flow. Through coding, each activity must be tied to an element in the WBS. This will provide the link between the time elements (schedule activities) and the cost elements (WBS). Through this link, it is possible to generate the required values for earned value calculations, as will be shown later.

### REPORTING PROGRESS

Actual costs are recorded by the financial systems through invoices and time sheets. These are transmitted to the earned value system to provide the Actual Cost of Work Performed (ACWP). The progress information is entered on the CPM schedule update report and processed by the CPM program. This progress can be reported in various forms. The simplest is merely to report activity starts and finishes. A more involved method includes, in

addition, an estimate of the percent complete for each in-process activity. The specific method depends on the earning rules used.

Assuming the use of the popular "50-50 Rule," the only progress information that needs to be reported are the actual start and finish dates. The system does the rest. With this rule, each activity is credited with (it "earns") 50 percent of its budget when the start of that activity is reported and the remaining 50 percent when the finish is reported. If the criteria for determining the detail of the CPM schedule are adopted, as described above, this method works effectively. There will be enough detail to overcome the apparent sawtooth pattern of earnings. The key is that project progress is being reported by physically accounting for the work being done as the activity starts and finishes are reported, not by measuring the incurred costs. Costs only imply progress, they do not guarantee it.

As the physical progress is recorded, the earned value system calculates the BCWP for each activity, using the allocated budget as a basis. By adding up the individual earnings for the total project, one can get the project percent complete by dividing the project BCWP by the project total Budget At Completion (BAC). In fact, by definition, BCWP and percent complete are two different expressions of the same value: project progress.

$$\text{Progress} = \frac{\text{Percent Complete} = \text{BCWP}}{\text{BAC}}$$

This measure of percent complete can then be used to determine the amount of revenue to recognize. Note that actual costs incurred do not enter into the calculation of percent complete. This makes sense, since the expenditure of funds does not guarantee project progress. Cost performance can vary considerably on a project, and therefore is best left out of the progress calculation.

### The Result

The result of this process is an objective measure of project progress that can be compared with the planned progress and with the actual cost. This provides cost and schedule

performance data, which management can use to assess where the project is heading. Clients can use the data to track the progress of their project. Accountants can use the data to report profitability to the investment community. Figure 1 illustrates the elements of an earned value system. Such graphic information is typical output of a project management system. This particular illustration shows a project manager's nightmare. The project is behind schedule and over budget. It is behind because the earned value (BCWP) is less than the planned value, also called the Budgeted Cost of Work Scheduled (BCWS). It is over budget because the Actual Cost of Work Performed (ACWP) is greater than the earned value (BCWP). This illustration also shows how the traditional cost-to-cost method of calculating percent complete can be misleading. According to that method, the project illustrated in Figure 1 would be ahead of schedule since the actual cost is greater than the planned cost. As a result, excessive revenues would be recognized.

An earned value system provides a wealth of information for accountants, project managers, corporate managers and clients. Figure 2 illustrates a typical report that displays all the required analysis information on a single report. This report is divided into three sections vertically: percentage values, labour-hour values and performance values. The percentage section displays the planned and ac-

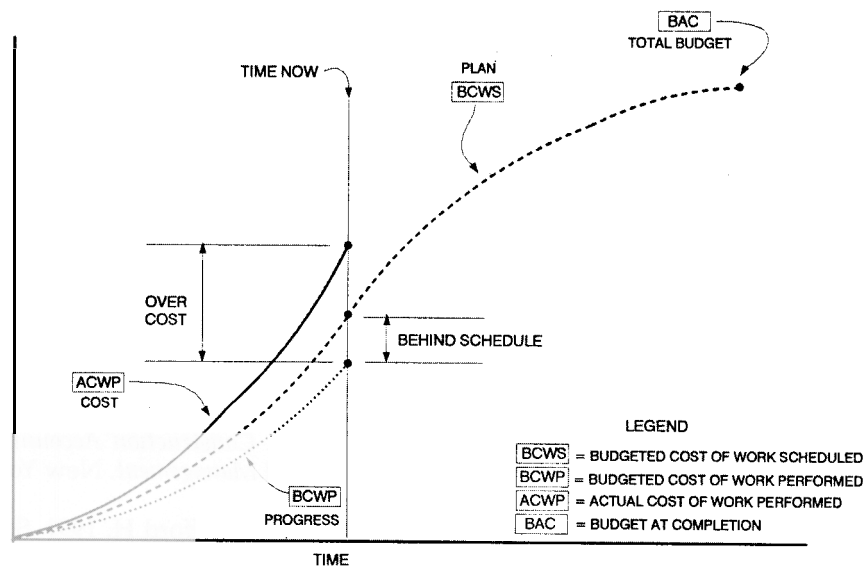


Figure 1. Performance Measurement Data Elements

tual percent complete, as well as the difference. The labour-hour section displays the planned budget, the earned value, the actual cost, the schedule variance and the cost variance. This could easily be replaced by a dollar cost section. The performance section displays the schedule and cost performance indexes. The latter section provides a quick view of how the various portions of the project are doing, using ratios to put each portion on a similar basis. Ratios seem to be easier to analyze than mentally comparing absolute cost values. In addition, the report is divided horizontally into three lines.

The top line for each item is for the current accounting period, the middle line is for the project to-date and the bottom line is for the project at completion.

By scanning a report such as this, the manager can quickly assess the status of the project in total. The manager can also quickly determine which portions of the work contributed to poor and good performance by reading down through the WBS. Each level of the WBS will provide more detailed analysis of the performance.

### The Problem

As so much else in this world, earned value does not come free. The cost of employing this powerful tool is the need to solicit the entire project team's support in providing the data. The system will not run by itself, it will only "crunch numbers" to provide information for analysis by the interested parties. The project team must provide the scope of work (list of "deliverables"), the breakdown of the work into activities for scheduling, the logic ties and durations for the CPM schedule, the estimate of the cost for doing the work, periodic update information on the CPM schedule and actual costs on their time sheets. While this may sound like a lot of information to request from people who are more interested in getting on with the production effort, with careful organization

WBS ID	DESCRIPTION	PER CENT COMPLETE			MANHOURS					PERFORMANCE	
		PLANNED	ACTUAL	VAR.	PLANNED	EARNED	ACTUAL	SVAR	CVAR	SCHED	COST
		(BCWS)	(BCWP)	(SVAR)	(BCWS)	(BCWP)	(ACWP)	(SVAR)	(CVAR)	(SPI)	(CPI)
1A	STUDIES & CRITERIA										
	CURRENT >>>>	1.3%	10.2%	8.9%	98	782	513	684	269	7.98	1.52
	TO DATE >>>>	99.1%	96.6%	-2.5%	7629	7437	7903	-192	-466	0.97	0.94
	AT COMP >>>>	100.0%			7699		8165		-466		
1B	CIVIL SYSTEMS										
	CURRENT >>>>	20.9%	23.8%	3.0%	889	1015	401	126	614	1.14	2.53
	TO DATE >>>>	24.7%	29.3%	4.6%	1053	1249	1149	196	100	1.19	1.09
	AT COMP >>>>	100.0%			4258		4158		100		
1C	MECHANICAL SYSTEMS										
	CURRENT >>>>	34.7%	18.5%	-16.1%	1559	833	1175	-726	-342	0.53	0.71
	TO DATE >>>>	41.7%	30.1%	-11.6%	1877	1355	1803	-522	-448	0.72	0.75
	AT COMP >>>>	100.0%			4498		4946		-448		
1D	ELECTRICAL SYSTEMS										
	CURRENT >>>>	47.1%	55.4%	8.2%	7391	8679	5040	1288	3639	1.17	1.72
	TO DATE >>>>	62.0%	65.8%	3.7%	9728	10311	8338	583	1973	1.06	1.24
	AT COMP >>>>	100.0%			15678		13705		1973		
1E	ARCHITECTURAL SYSTEMS										
	CURRENT >>>>	13.2%	21.2%	7.9%	866	1385	1037	519	348	1.60	1.34
	TO DATE >>>>	21.4%	21.2%	-0.2%	1400	1385	1037	-15	348	0.99	1.34
	AT COMP >>>>	100.0%			6542		6194		348		
1	TOTAL PROJECT										
	CURRENT >>>>	27.9%	32.8%	4.9%	10803	12694	8166	1891	4528	1.18	1.55
	TO DATE >>>>	56.1%	56.2%	0.1%	21687	21737	20230	50	1507	1.00	1.07
	AT COMP >>>>	100.0%			38675		37168		1507		

Figure 2. Synoptic Performance Report

and simple procedures, the whole process can be made relatively painless.

In addition to the support of the whole project team, it will be necessary to have a dedicated staff to operate the system. The size of this staff depends on the size of the project and the amount of detail at which the system is to be operated. Staffs vary from as small as one person to as large as a whole department for one project and every size in between.

However, these problems are relatively easy to overcome. The more pressing problem is that of estimating the budgets on which the earnings will be based. While extreme accuracy is not required, the better the estimate, the better the resulting analysis. The more experienced the individuals doing the estimating, the better the budgets will be. It is generally better to let the responsible team members do the estimating. This enhances the accuracy of the estimates and also gives the team members the opportunity to participate in the planning by enhancing their support during execution. The key to remember is that the entire project budget must be allocated. The difficulty is in deciding how much to allocate to each component. It is also wise to set aside a significant part of the budget in a management reserve account. No matter how experienced we are, it is practically impossible to identify each and every component at the required detail for the entire project right at the beginning. The reserve account is to hold undistributed budget that will be available for the detailed activities when they are identified later on in the project.

## CONCLUSION

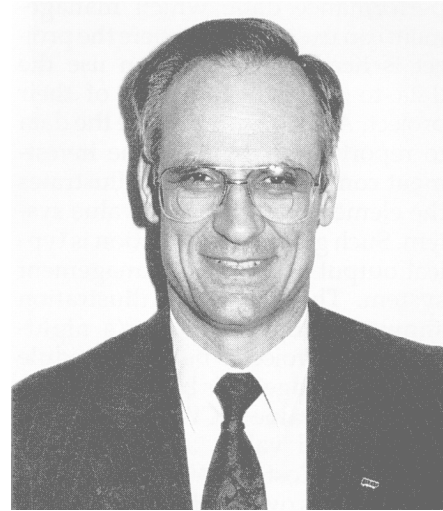
The needs of the accounting and investment communities are specific: provide a consistent, predictable means of recognizing revenues. This will provide better understanding of a company's financial position by investors.

Similarly project and corporate managers are interested in an accurate measure of their project status and performance. Earned value satisfies both needs by providing an objective measure of project percent complete. In line with the AICPA Statement of Position, earned value provides a means to allow progressive recognition of revenues for long projects. It

does so by recognizing physical progress on the project rather than assuming that incurring costs produce comparable progress.

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