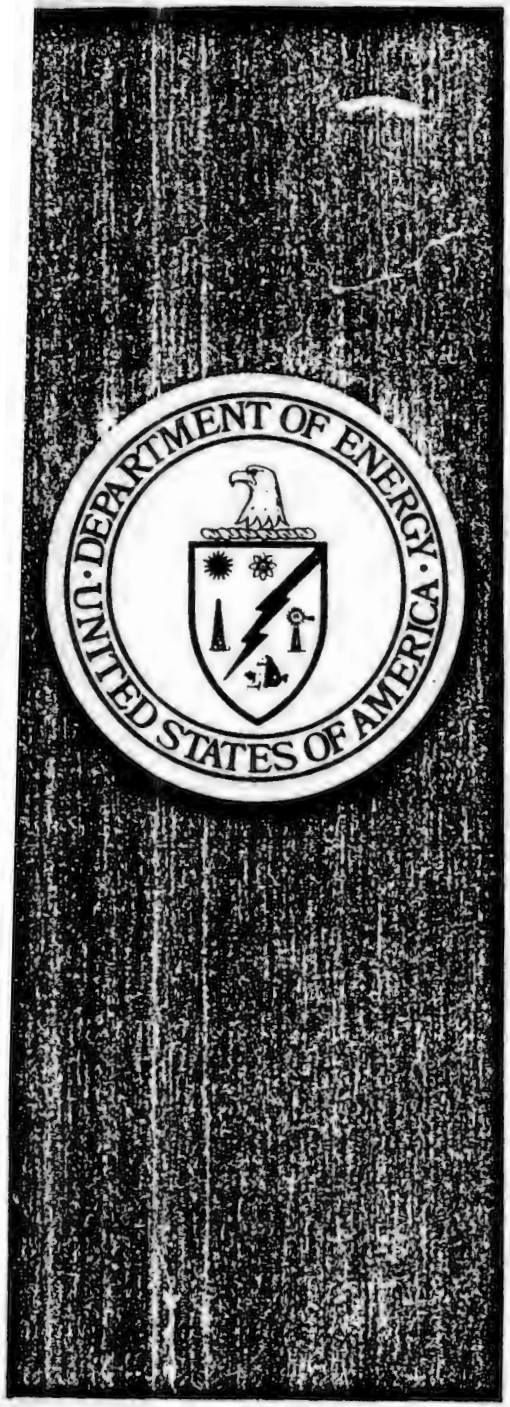
DOE/MA-0155

COST & SCHEDULE CONTROL SYSTEMS CRITERIA FOR CONTRACT PERFORMANCE MEASUREMENT

INFORMATION PAMPHLET

May 1984

U.S. Department of Energy
Assistant Secretary, Management and Administration
Director of Administration
Office of Project and Facilities Management



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THE COST AND SCHEDULE CONTROL SYSTEMS CRITERIA (CSCSC)

Assistant Secretary, Management and Administration
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The purpose of this pamphlet is to inform interested DOE and industry personnel about the basic concepts and general requirements of the Cost and Schedule Control Systems Criteria of DOE Order 2250.1A. The graphic illustrations used herein are provided solely as aids to communication and are not intended to prescribe specific methods of organization or operation. Persons desiring more definitive information relative to CSCSC policy and procedures should refer to DOE Order 2250.1A, COST AND SCHEDULE CONTROL SYSTEMS CRITERIA FOR CONTRACT PERFORMANCE MEASUREMENT, the Summary Description (DOE/CR-0014), the Implementation Guide (DOE/CR-0015), the Work Breakdown Structure Guide (DOE/MA0040), the Contractor Reporting and Data Analysis Guide (DOE/CR0017), and the Surveillance Guide (DOE/CR-0018).

THE COST AND SCHEDULE CONTROL SYSTEMS CRITERIA (CSCSC)

The Cost and Schedule Control Systems Criteria do not represent a management system nor do they prescribe specific methods of organization or operation. The criteria are intended to serve as standards for measuring adequacy of management control systems. Contractors are free to organize in the manner best suited to their individual environments and management philosophies and may select the internal methods and procedures of their choice. However, these methods and procedures must result in systems which provide the data and capabilities specified in the criteria in order to be acceptable to the Department of Energy.

COST & SCHEDULE CONTROL SYSTEMS CRITERIA

CSCSC

A SET OF STANDARD CRITERIA USED BY GOVERNMENT TEAMS TO EVALUATE THE ADEQUACY OF CONTRACTORS' INTERNAL COST AND SCHEDULE CONTROL SYSTEMS

OBJECTIVES IN USING THE CRITERIA

In an effort to obtain consistent, reliable data on the status of major system acquisitions and major projects, the Government has instituted a number of different approaches, ranging from complete reliance on contractors' existing internal systems to the imposition of detailed management systems for contractors to use during the performance of contracts. The criteria approach differs from previous efforts in that it allows contractors to use the specific management procedures of their choice, but sets forth the characteristics and capabilities which should be inherent in an effective cost and schedule control system.

The Department of Energy's objective is twofold: First, to obtain assurance that contractors' internal management systems are sound; and, once this is accomplished, to rely on summarized data for contract management requesting detailed data only in those areas where problems exist.

OBJECTIVES IN USING THE CRITERIA

- TO PROVIDE AN ACCURATE STATUS OF CONTRACT PROGRESS.
- TO PROVIDE EARLY VISIBILITY TO PROBLEMS — PREVENT "SURPRISES"
- TO IMPROVE ESTIMATED FINAL COST PROJECTIONS
- TO IMPROVE ON SHORTCOMINGS OF PRIOR REQUIREMENTS
- TO MINIMIZE PROLIFERATION OF SYSTEMS AND DATA PROBLEMS

CRITERIA

The CSCSC contain thirty-five criteria which are grouped into five major categories. Generally, the five sections deal with the following requirements:

1. Organization. These criteria require that the contractor's system provides for clear definition of the overall contractual effort, with a work breakdown structure serving as a framework for displaying subdivisions of effort. Integration of the work breakdown structure with the functional organization structure is required in order to provide for assignment of responsibilities for identified work tasks. Additionally, integration of the planning, scheduling, budgeting, work authorizing and cost accumulating subsystems is a key element in an effective control system.

2. Planning and Budgeting. All authorized work must be planned, scheduled, budgeted and authorized within the system. Establishment of the performance measurement baseline is the key requirement of this section.

3. Accounting. Costs of completed work must be accumulated from the levels at which costs are initially recorded to the summary level as directly as possible without need for allocations in summation. Cost of materials should be handled in such a way that the cost of work does not include cost of materials not yet on hand.

4. Analysis. Comparisons of actual versus planned performance are required by this group of criteria. Thresholds for variance analyses should be established to avoid excess effort which may otherwise result from analyzing insignificant variances. It is particularly important that variances be examined in terms of increments or aggregations of work which are large enough to produce significant information. Analyzing individual work package variances, for example, should not be necessary and would probably not be cost effective, other than on an exception basis.

5. Revisions and Access to Data. Incorporation of changes authorized by the Government and due to internal replanning are dealt with in this section. Particular emphasis is placed on the need to retain a meaningful performance measurement baseline. Other requirements include reconciliation of estimated costs at completion with funds requirements reports, and provisions for access to data during systems evaluations.

CRITERIA

- ORGANIZATION
  - DEFINE WORK AND ASSIGN RESPONSIBILITIES
- PLANNING AND BUDGETING
  - ESTABLISH THE PERFORMANCE MEASUREMENT BASELINE
- ACCOUNTING
  - RECORD COSTS OF WORK ACCOMPLISHED
- ANALYSIS
  - MEASURE PROGRESS AND ANALYZE VARIANCES FROM PLAN
- REVISIONS AND ACCESS TO DATA
  - CONTROL CHANGES TO BASELINE

ORGANIZATION

Define the Work

Since an important aspect of planning and control is the proper definition of the task to be performed, a work breakdown structure (WBS) can be a useful device for identifying the contractual effort. A WBS is simply a family-tree type subdivision of products, components, work tasks and services required to achieve a desired goal or produce an end-product. For performance measurement purposes, it is desirable that the WBS be structured in accordance with the way the work is actually going to be performed. However, the construction of a WBS must also consider other areas which require structured data, such as: scheduling, configuration management, historical cost collection, and contract funding.

The top three levels of the contract WBS are developed by the Government and negotiated with the contractor. These summary level items are included in the contract and provide a useful structure for future contract reporting. The contractor may extend the summary WBS in any manner he chooses in an effort to divide the contractual work into manageable pieces of effort before assigning internal responsibilities.

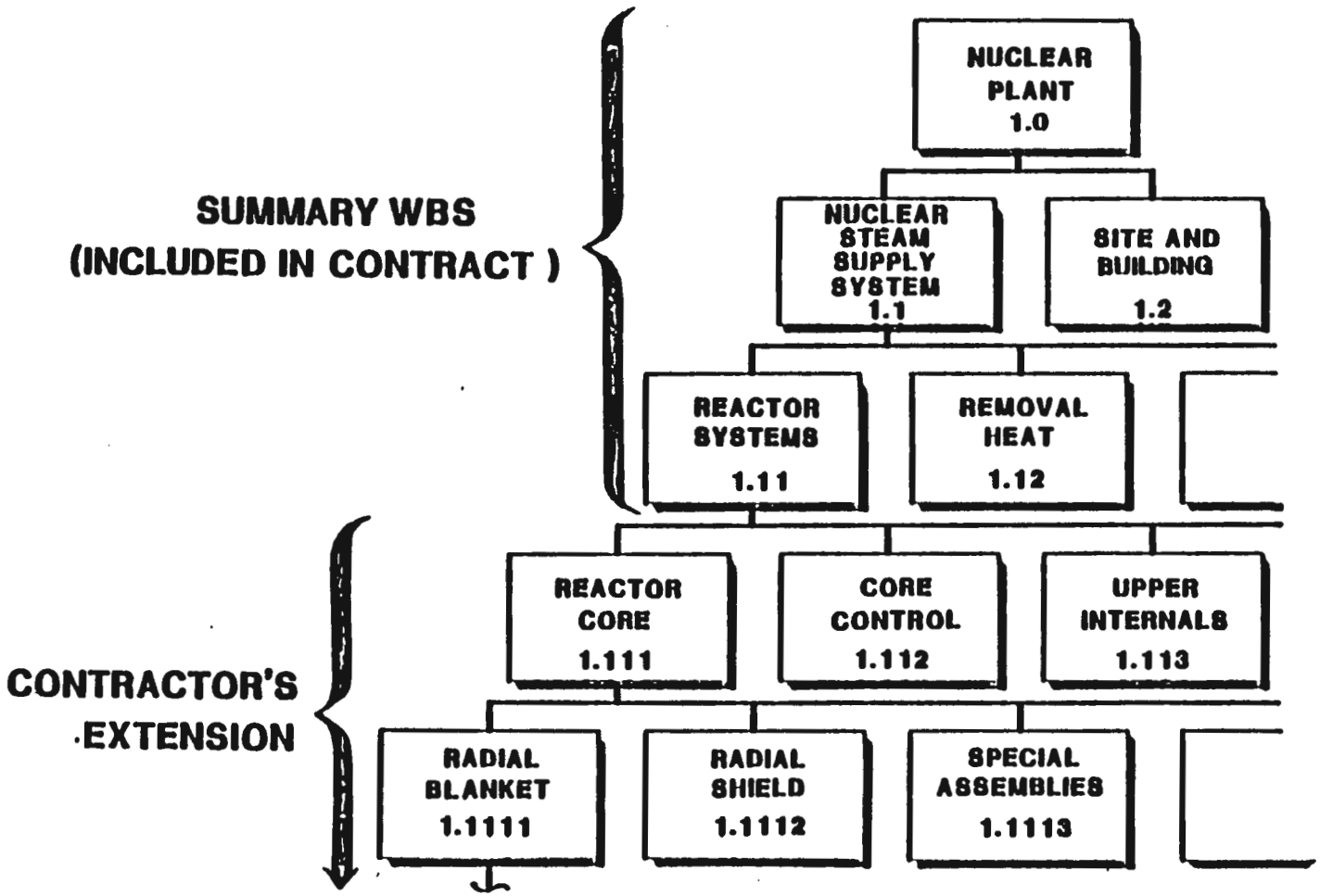
Although the WBS is primarily product-oriented, software, services and functional work tasks also may be included, provided each element is a meaningful product or management-oriented subdivision of a higher level element.

The contract WBS is very important to the effectiveness of a cost/schedule control system and considerable care should be exercised in its development. Contract line items should be included as separate WBS elements and the WBS should be aligned with the statement of work to the maximum possible extent. These actions will simplify the problems associated with future replanning and reporting.

Since it is important that the WBS reflect the way the work is to be done, the contractor must be given as much flexibility as possible to develop the elements below the summary reporting level. Lower levels of the WBS should not be specified by the Government, since this frequently results in too much detail, arbitrary subdivisions of the work, and subsequent difficulties in accumulating and reporting information on the contract.

ORGANIZATION

DEFINE THE WORK



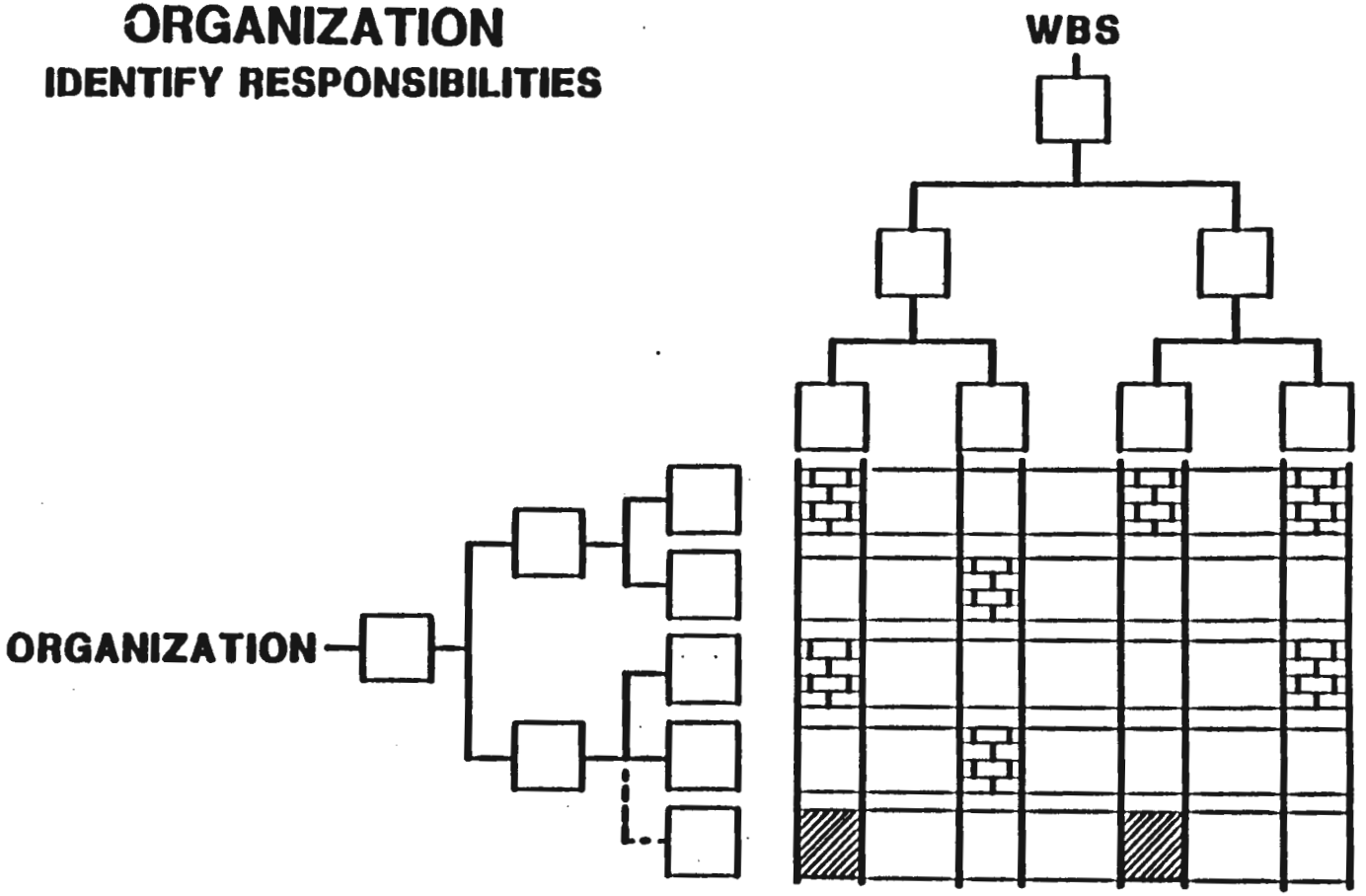
ORGANIZATION

Identify Responsibilities

The work breakdown structure is a formal method for identifying and defining the contractual effort. It is primarily hardware or product oriented. The contractor's organizational structure is also a formal structure, but reflects the manner in which the contractor has organized the people who will do the work. Integration of the organizational structure with the work breakdown structure is necessary in order to assign functional responsibility for the tasks to be performed. A matrix arrangement is a simple technique used by many contractors to accomplish this integration effectively. The effort identified by the integration of the two structures is referred to as the cost account and is probably the most important management control point in the contractor's system. As a result, this intersection is often selected as the appropriate point for collecting and analyzing costs and other information before summarizing for higher levels of management. Subcontractor data may also be incorporated into the system at this point.

Once functional responsibilities for the work have been established, further subdivision of the effort into work packages can be accomplished and the work can be identified to the performing organizations or individuals. This detail job planning and assignment normally forms the lowest level of the contract work breakdown structure.

ORGANIZATION
IDENTIFY RESPONSIBILITIES



PLANNING AND BUDGETING

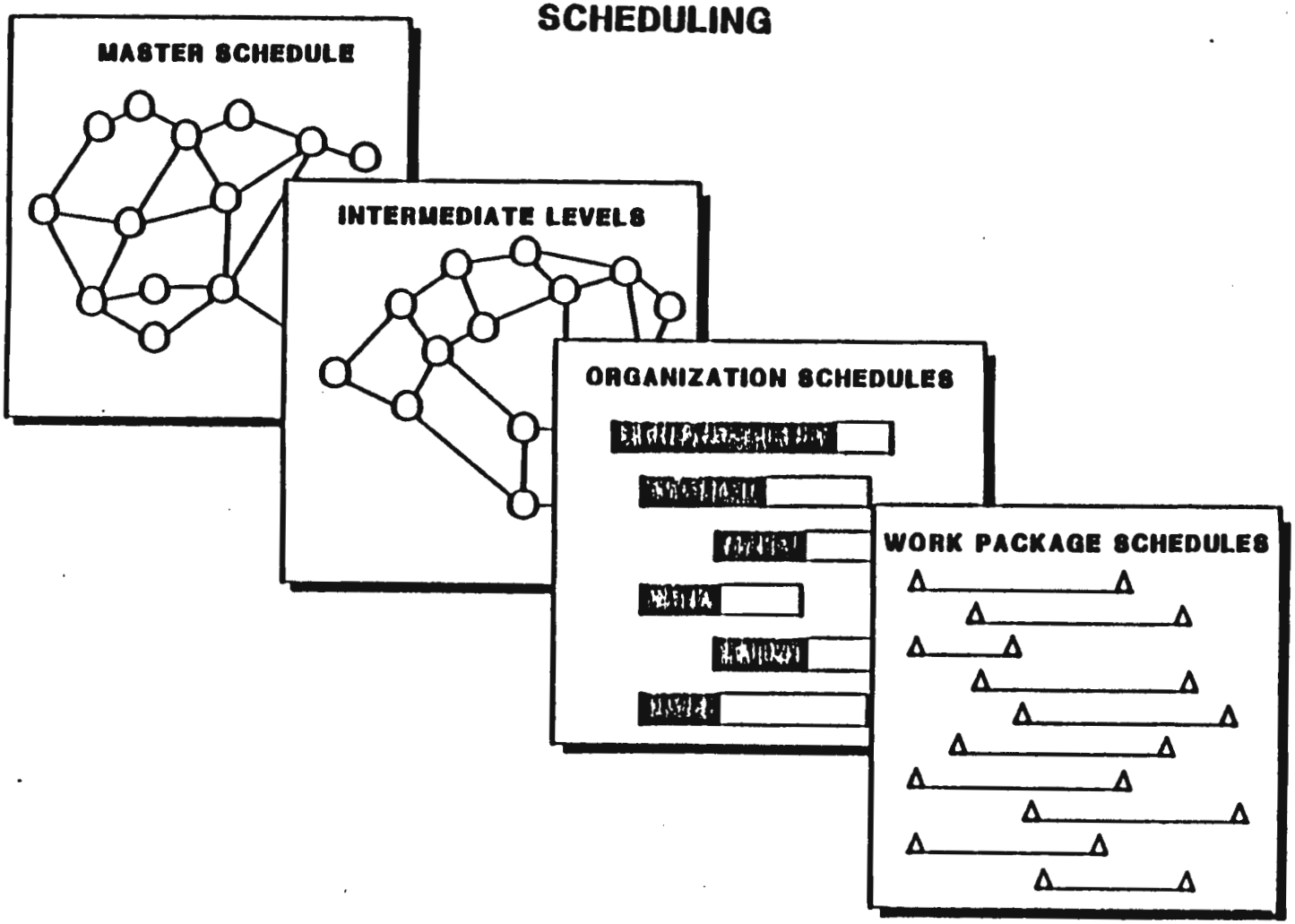
Scheduling

The CSCSC do not require contractors to use any specific scheduling technique. CPM, PERT, Line-of-Balance, Gantt, and milestone charts are all good techniques which are effective when properly employed. CSCSC scheduling requirements basically seek formality, consistency and discipline throughout the scheduling system regardless of the technique used. All authorized work must be formally scheduled in a manner which will permit the evaluation of actual progress against contract milestones and which will identify interdependencies of individual tasks.

The scheduling system should contain summary or master schedules which provide for all contractually specified milestones. The summary schedule(s) should be clearly supported by lower level schedules which link the summary to the detail tasks. All cost accounts and work packages must contain specific start and completion dates which are based on physical accomplishment and are clearly integratable with formal project or organization schedules. Intermediate level schedules should provide a logical sequence from the cost accounts to the summary level.

PLANNING AND BUDGETING

SCHEDULING



PLANNING AND BUDGETING

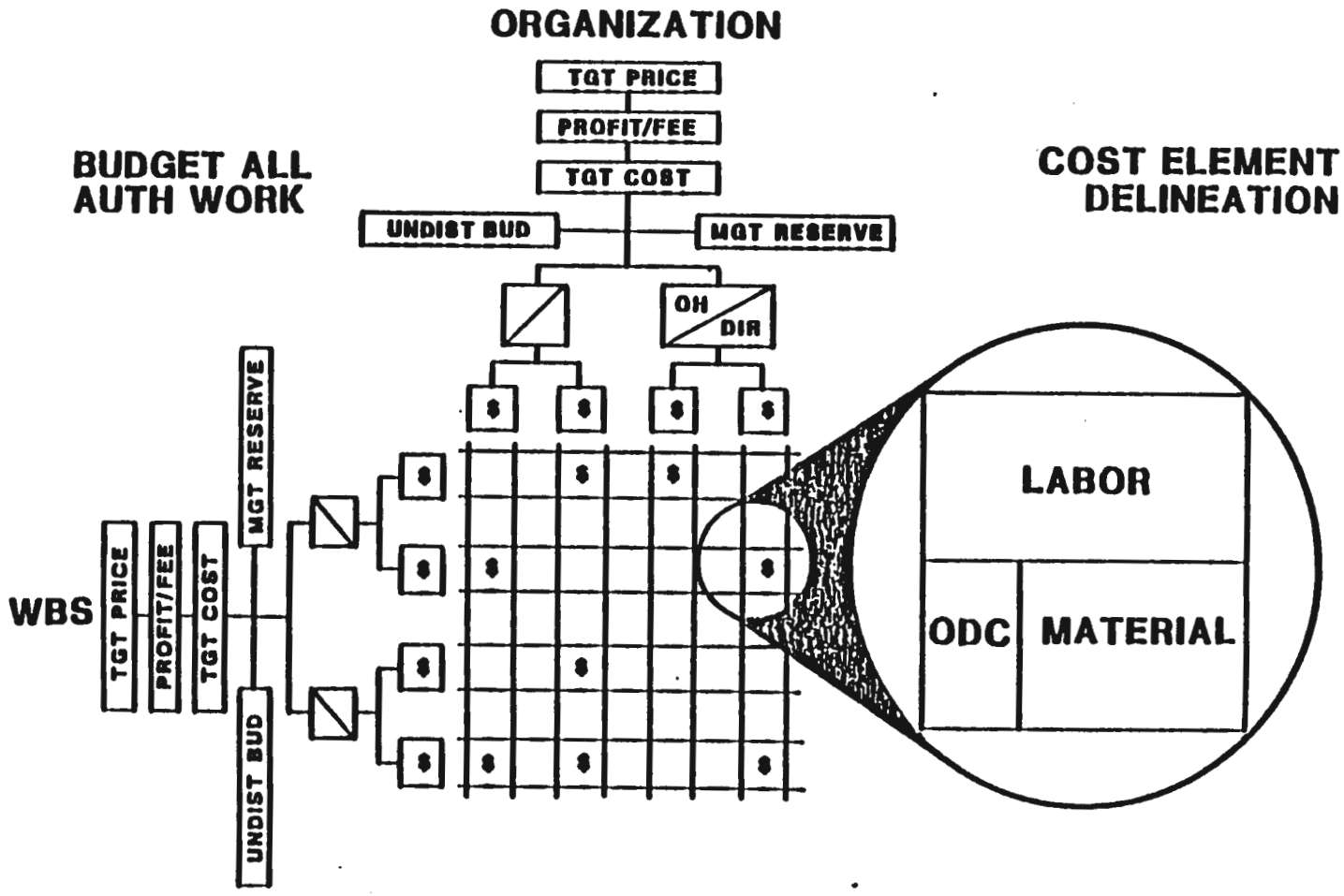
Once the contractual effort is planned and scheduled to the greatest possible extent, budget distribution can be made to responsible organizations for specific tasks. Since budgets will be used to measure cost performance, it is necessary to assign a budget to each increment of work. The integration of the WBS and organizational structure should permit the assignment of budget to cost accounts regardless of whether budgets are distributed functionally or by WBS element.

The CSCSC recognize the constructive use of management reserves for control purposes, but require the contractor to clearly identify all reserves regardless of the level at which they are maintained. As reserves are used during the life of the contract, their application is reported on the Cost Performance Report.

Budgets distributed to cost accounts, undistributed budgets, and management reserves should add up to the contract target cost on incentive contracts, or to the estimated cost on fixed fee contracts. Budgets assigned to authorized work in this fashion provide the basis for measuring cost performance. In other words, each increment of work will have a budget which represents its planned cost or planned value in terms of the total contract. As the work is accomplished, the actual costs incurred can be compared to the budget or planned cost to determine whether more or less money has been spent than was planned for that work. Variances can be analyzed to determine reasons for deviations and corrective actions can be initiated if necessary.

Cost element delineation is required to provide the capability to analyze performance in terms of labor, material or other direct costs. Indirect costs, however, need not be controlled at the cost account or work package levels, but must be budgeted at the level identified by management for control of such costs.

PLANNING AND BUDGETING



PLANNING AND BUDGETING

Establish the Baseline - An Interactive 3-Step Process

An important ingredient in a measurement system is the establishment of a meaningful baseline which can be used to measure accomplishment during performance of the project. In a cost/schedule performance measurement system, the measurement baseline results from integrating the contract work, schedule and budget with each other through an iterative planning process.

The work breakdown structure is an aid to work identification and definition. This top-down, progressive subdivision of the contractual effort forces recognition of the total scope of the effort, overcoming the tendency to focus on only the near-term activity.

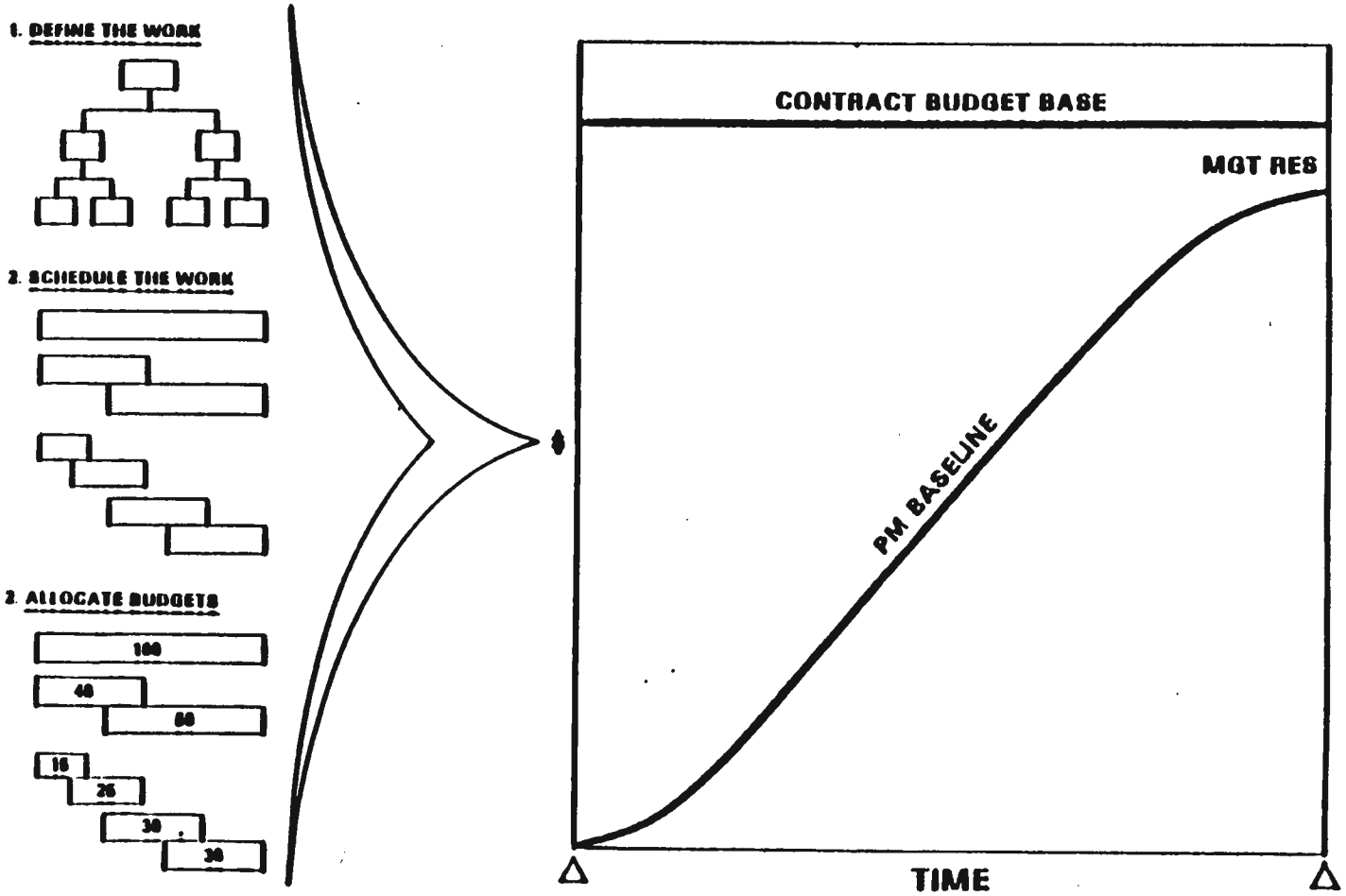
Scheduling often leads to even better work definition since this activity requires quantification of the work and recognition of the sequence in which it must be done and the interrelationships between activities. In addition, the contract establishes schedule milestones and targets within which the effort must be performed.

Budgeting is the process of allocating resources to the scheduled activity. Again, contractual targets establish limitations on the resources which can be provided to the managers of the work.

The process of work planning, scheduling and budgeting effectively integrates these elements and provides a useful baseline to which actual accomplishment can be compared. The contract establishes the boundaries within which the work is to be accomplished by providing a statement of work, schedule targets and cost targets. In order to effectively measure contract performance, these targets must establish the framework within which the contractual effort is performed. The inability to perform within that framework results in contract overruns and schedule slippages.

PLANNING AND BUDGETING

ESTABLISH THE BASELINE — AN ITERATIVE 3-STEP PROCESS



PLANNING AND BUDGETING

Establish Work Packages/Planning Packages

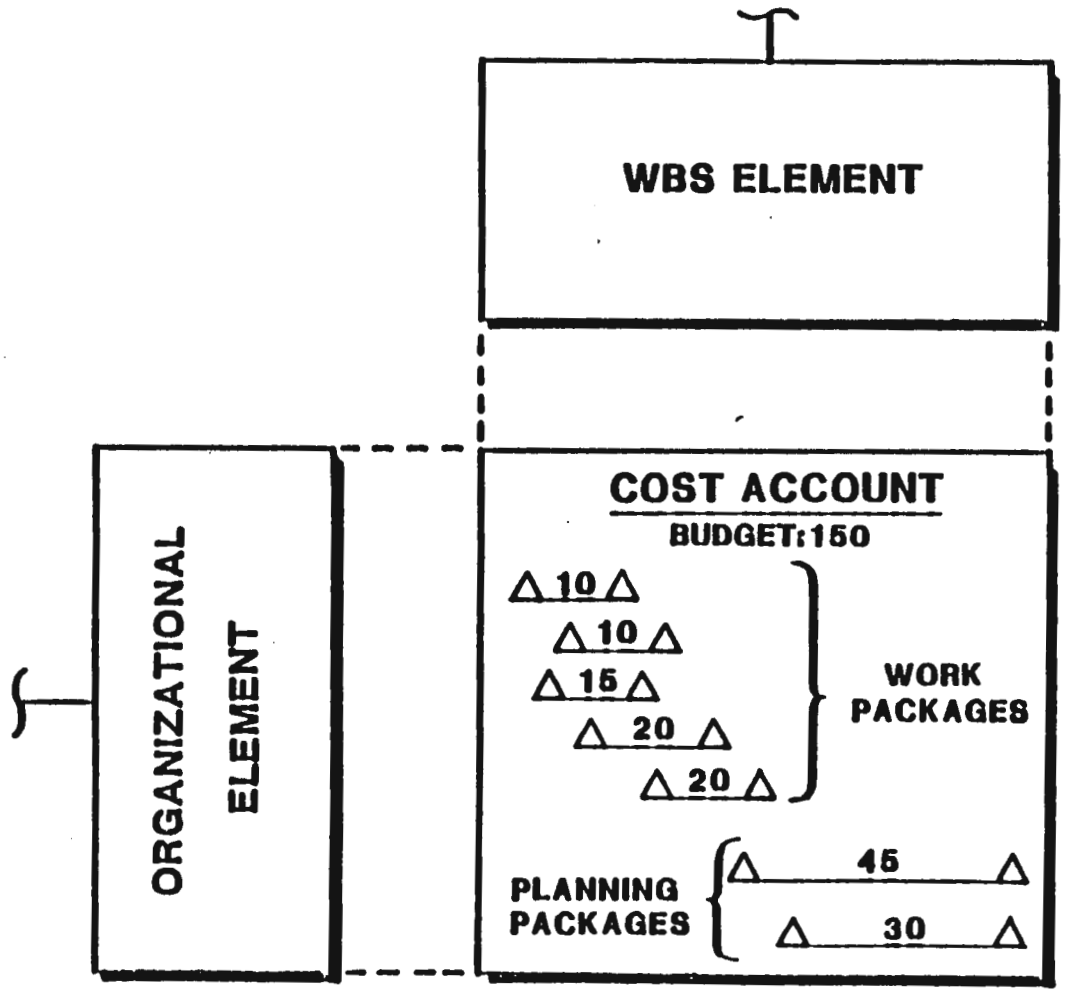
The cost account represents one functional organization's piece of one work breakdown structure element. The cost account manager is responsible for getting the work done within assigned budget and schedule targets. In order to do this, the work is further subdivided into job assignments, usually in the form of work orders, engineering task authorizations, etc.

Insofar as possible, the work is broken down into short-span discrete units of work called work packages. Far-term effort within the cost account, which cannot logically be identified into work packages, may be organized into larger units of effort called planning packages. The main purpose of the planning package is to insure that adequate budgets are set aside for the work which must be done. In cost accounts which are very long (over a year) planning packages are used for baseline control, to insure that budget associated with downstream effort is not inadvertently used coping with current problems.

While work package planning is not required for the entire cost account at the outset, such planning is required for about six months into the future. Unopened work packages may be replanned, if desired, as conditions dictate.

PLANNING AND BUDGETING

ESTABLISH WORK PACKAGES/PLANNING PACKAGES



PLANNING AND BUDGETING

Work Package Characteristics

Work packages are the basic building blocks used for detailed planning, assignment and control of contract performance. The criteria list several characteristics applicable to work packages, generally requiring that the task be clearly defined, scheduled, budgeted and assigned to a single organization responsible for its completion.

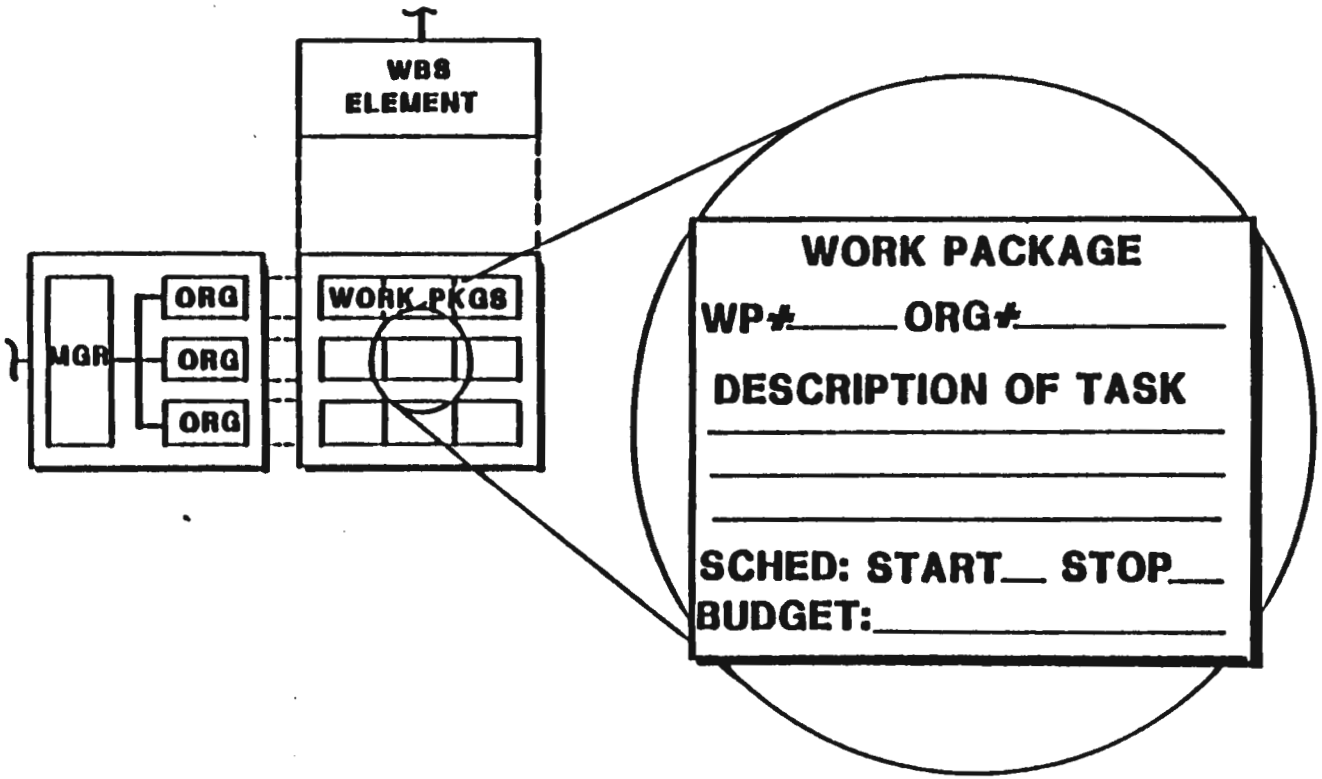
Of all the work package requirements, however, one of the most important from the standpoint of performance measurement is the desirability of keeping them relatively short in duration. The reason for wanting short-span work packages is to reduce the problems associated with determining the amount and value of completed work. The simplest procedure for determining accomplishment would be to consider only closed work packages, since it is no problem to add up budgets for completed work. However, some consideration should also be given to the amount of work accomplished within open work packages since actual costs are being recorded for all work performed. The longer the work packages, the greater the amount of work which will be in process at the reporting cut-off, and the more difficult it becomes to determine the amount and value of completed in-process effort.

Short work packages can be virtually ignored until they are completed, or, if desired, a simple formula can be used to calculate an approximate value applicable to the in-process work. Longer work packages can either be subdivided into value milestones, or some other objective means of determining completed effort can be used. A general rule of thumb is that work packages which exceed two reporting periods in duration probably ought to be evaluated using some means other than an arbitrary formula.

If work packages are subdivided into lower level work authorizations, budgets and standards used at the lower levels must be consistent with and supportive of the work package budget to insure total system integrity.

PLANNING AND BUDGETING

WORK PACKAGE CHARACTERISTICS



ACCOUNTING

Material Costs

An objective of the criteria is to compare the actual cost of completed work with the planned cost for that work and analyze significant variances in order to understand cost problems and assess their impact on the contract. In this context, cost of completed work should include the cost of all resources associated with work accomplished, but should not include costs applicable to outstanding commitments. This does not mean that commitment information should be disregarded. Planned versus actual commitments provide the earliest indications of material cost problems and should be carefully monitored by the contractor and the procuring activity. Significant material price variances identified at the point of commitment should be reflected in the contractor's estimated cost at completion reported in the Cost Performance Report. In addition, contract funds status reports usually reflect commitment plans and actuals in support of contract funding requirements.

However, for performance measurement purposes, placing a purchase order does not represent accomplishment of the contractual effort for which the material is being ordered, and it would be premature to reflect the material costs as "incurred" at that time. Physical receipt of the material, on the other hand, does represent accomplishment and material costs can be meaningfully compared to planned costs at that point. Actual payment of invoices is another logical time to record material costs, as is issuance of the material to the work in process. Since different types of materials may be applied to the contract at different times, the criteria can accommodate any point after the material has been received. For example, high dollar value items purchased on a one-for-one basis where no attrition is expected, could be accounted for at time of receipt. Raw materials, purchased in large quantities for several contracts at the same time, might not be charged to the contract until withdrawn from stores for use.

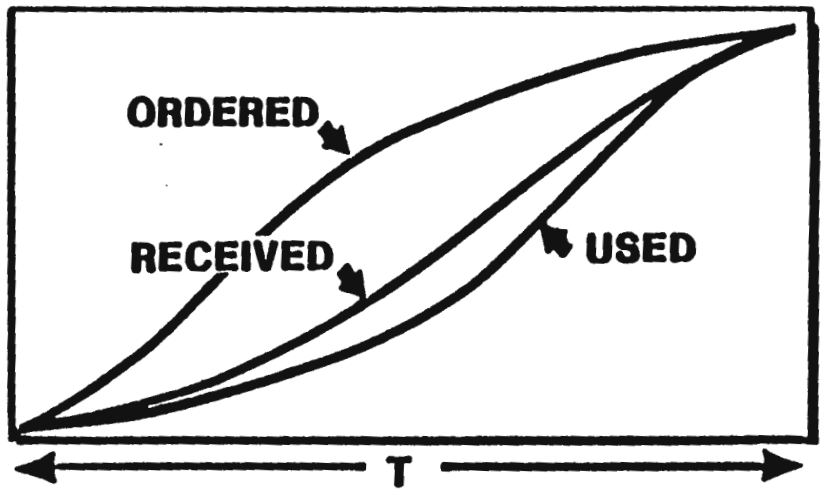
Regardless of the methods used for material accounting, the contractor's system must be able to provide: material price variances, cost variances associated with excess material usage, reasonably accurate unit and lot cost information, comparability with baseline budgets, and full accountability for all materials purchased for the contract.

If material costs are recorded at the time materials are received (and prior to payment of invoices), "estimated actuals" may be used for performance measurement purposes.

ACCOUNTING

MATERIAL COSTS

- ▲ MATERIAL ORDERED
- ▲ MATERIAL RECEIVED
- ▲ INVOICES PAID
- ▲ WITHDRAWN FROM STORES
- ▲ MATERIAL CONSUMED



- ALL METHODS USED MUST FACILITATE PERFORMANCE MEASUREMENT AND UNIT/LOT COST DETERMINATION BY PROVIDING
  - PRICE VARIANCES
  - USAGE VARIANCES
  - ACCURATE COST ACCUMULATION CONSISTENT WITH BUDGETS
  - MATERIAL ACCOUNTABILITY

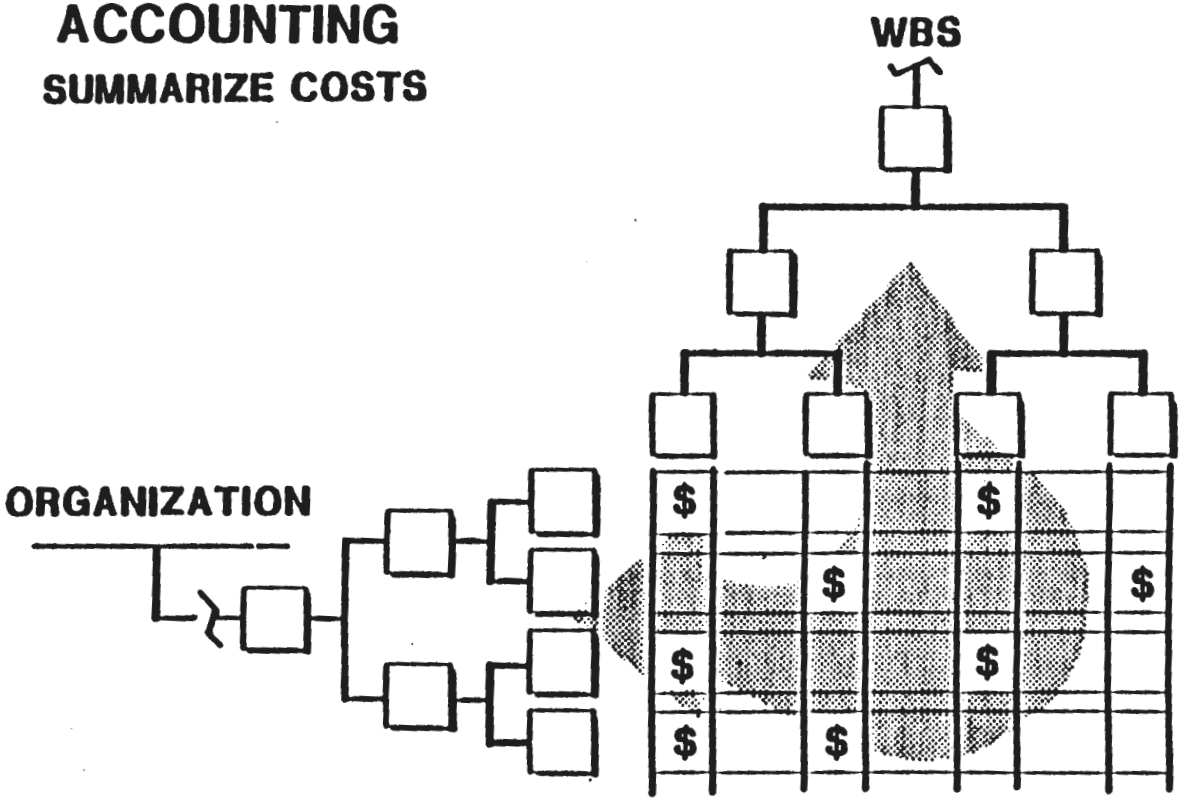
ACCOUNTING

Summarize Costs

The accounting criteria of the CSCSC primarily require that the contractor be able to accumulate all direct costs in cost accounts and summarize them to the contract level. Cost accumulation by WBS elements or by organizational elements is facilitated by the WBS/organization structure integration which exists at the cost account level. As with the budgeting criteria, indirect costs do not have to be collected at the cost account level, but may be accumulated at the level selected for management control of such costs. Summarization of both direct and indirect costs from the level at which they are initially recorded to the contract level should be possible without the need for allocations between higher level WBS elements.

Contractors' accounting systems are subject to continual scrutiny by the cognizant Federal auditor. An auditor may also serve as a principal member of the demonstration review team. Accounting procedures which are acceptable to the Federal auditor will generally satisfy the requirements of CSCSC and no attempt is made to evaluate audit procedures or reaudit significant portions of the accounting system during systems demonstrations. Simple reconciliations are made to verify that summary level reports are properly supported by detail level data and that cost reports used for different purposes are reconcilable and support each other. For example, contract funding requirements reported in the Project Status Report should be reconcilable with estimated costs at completion reported on Cost Performance Reports.

ACCOUNTING
SUMMARIZE COSTS



ANALYSIS

Budgeted Cost for Work Scheduled (BCWS)

In addition to the actual cost of work performed, the criteria require the determination of the Budgeted Cost for Work Scheduled (BCWS). The Budgeted Cost for Work Scheduled is the budget applicable to the work scheduled to be accomplished within a given time frame. BCWS is determined by adding up the budgets applicable to work packages scheduled to be accomplished. To this is added an estimated budget for the amount of in-process work scheduled to be accomplished as well as the budget for level-of-effort and apportioned effort scheduled to be accomplished.

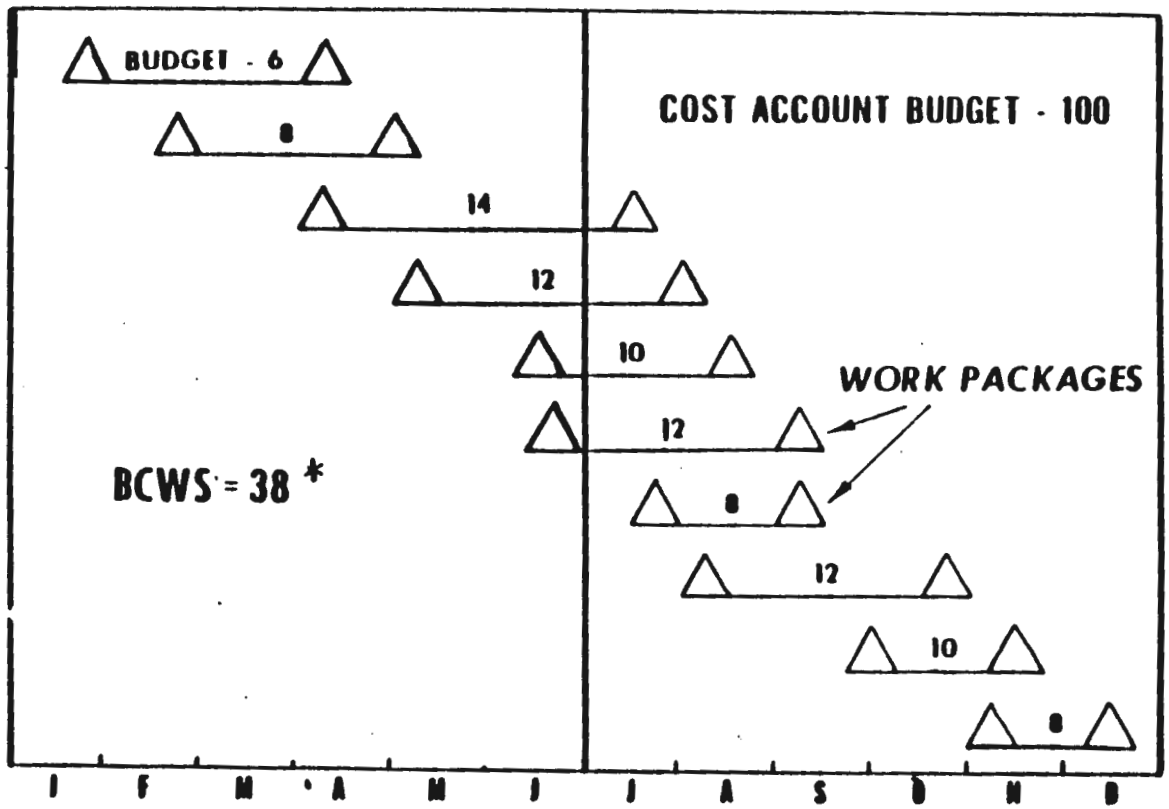
In the example shown, the BCWS of 38 was determined as follows:

Budget for 2 work packages scheduled to be accomplished	- 14
Budget for 4 work packages scheduled to be in-process	- 24
BCWS	- 38

The budget applicable to the in-process work was derived by an arbitrary method; i.e., by simply taking half the budget for each work package at the time the work was scheduled to begin. (The other half would be taken at the time the work is scheduled to be completed.) This is merely an example of one technique which may be used where work packages are relatively short in duration. Due to the large numbers of work packages which are being considered, the amount of distortion resulting from such a procedure is minimal and the procedure has the advantage of being simple to implement.

The procedure described in this example should not be construed as being prescribed by the criteria or the DOE. The contractor is free to choose the work-in-process measurement technique he wishes; however, the procedures used must be rational, formal, and applied in a consistent fashion. Different techniques may be used for different work packages; i.e., an arbitrary approach such as the 50-50 rule for short work packages and a more objective method for longer work packages such as the use of value milestones.

BUDGETED COST FOR WORK SCHEDULED (BCWS)



* 50-50 RULE USED FOR WORK IN-PROCESS

ANALYSIS

Budgeted Cost for Work Performed (BCWP)

The Budgeted Cost for Work Performed (BCWP) is the budget applicable to the work actually accomplished. BCWP is determined by adding up the budgets of those work packages which have been completed along with an estimated amount of budget for the completed work in open work packages (including completed LOE and apportioned effort).

In the example shown the BCWP of 49 was determined as follows:

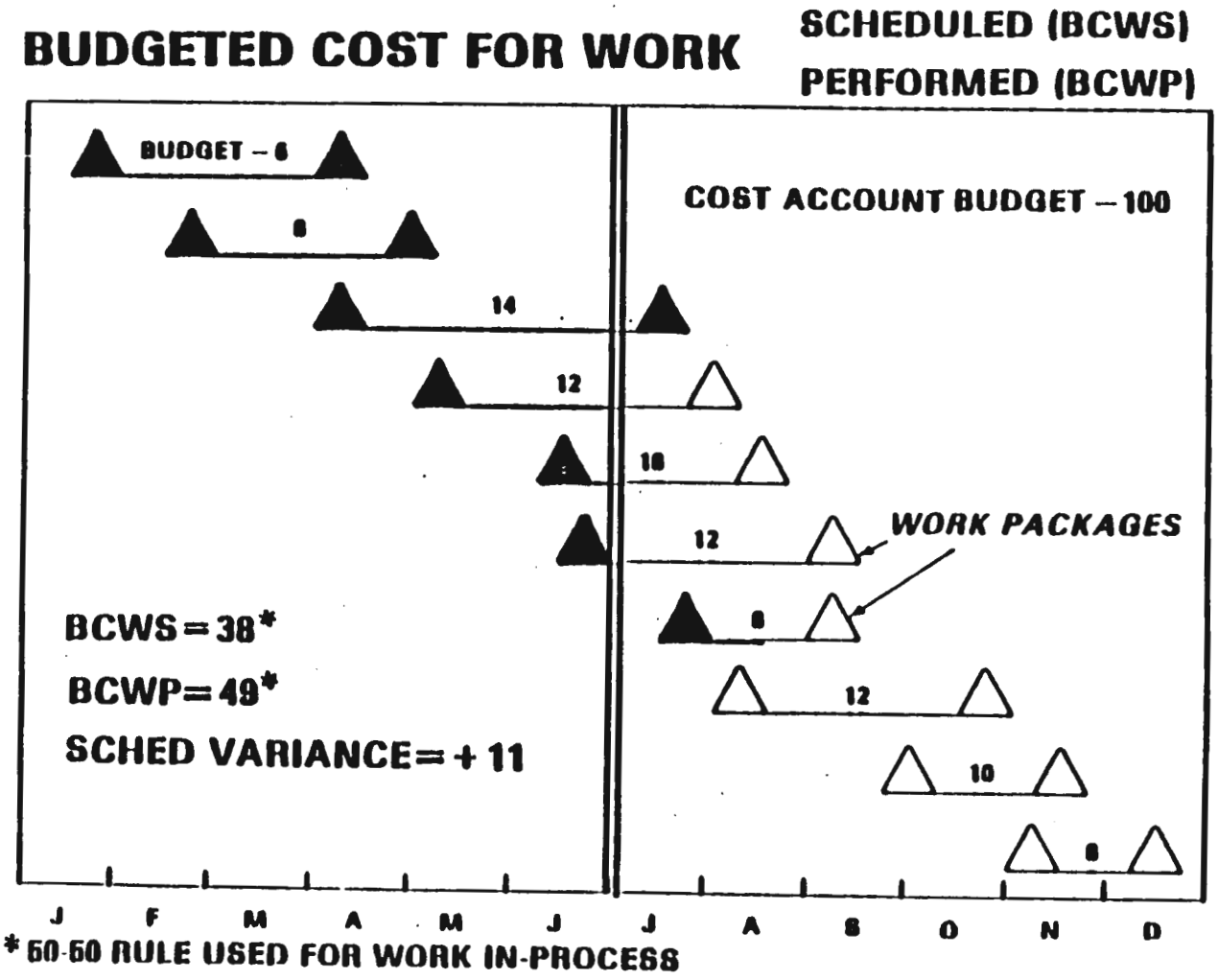
Budget for 3 work packages completed	- 28
Budget for 4 work packages in-process	- 21
BCWP	- 49

As with the BCWS example, the in-process work estimate was derived by taking half the budget for each work package at the time it was started with the other half to be taken when the work is finished.

The difference between BCWS and BCWP provides a schedule variance in terms of dollars. In this case, more work was performed than was scheduled to be done and the resulting variance is +11. This means that the value of the work which was done ahead of schedule is 11. Quantifying the value of a schedule deviation is one of the most important features of a Performance Measurement System since it enables a more accurate cost variance to be determined.

In the example shown, both BCWS and BCWP were determined using the same technique -- the 50-50 method. Determining BCWS and BCWP by the same procedure is a good general rule to follow since it makes the schedule variance most meaningful. However, it is not a hard and fast rule, and there may be exceptions. Acceptability of the methods used depends primarily on the amount of distortion which may result from planning the effort one way and determining progress another way. With very short work packages or value milestones, the distortion may not be significant.

ANALYSIS


BUDGETED COST FOR WORK
SCHEDULED (BCWS)
PERFORMED (BCWP)
BUDGET – 6
8
14
12
18
12
COST ACCOUNT BUDGET – 100
WORK PACKAGES
8
12
10
8
BCWS = 38*
BCWP = 49*
SCHED VARIANCE = + 11
J F M A M J J A S O N D
* 50-50 RULE USED FOR WORK IN-PROCESS

ANALYSIS

CSCSC Data Elements

A key CSCSC data element is the Budgeted Cost for Work Performed (BCWP). When compared with BCWS it provides a schedule variance. When compared with the Actual Cost of Work Performed (ACWP) it provides a cost variance.

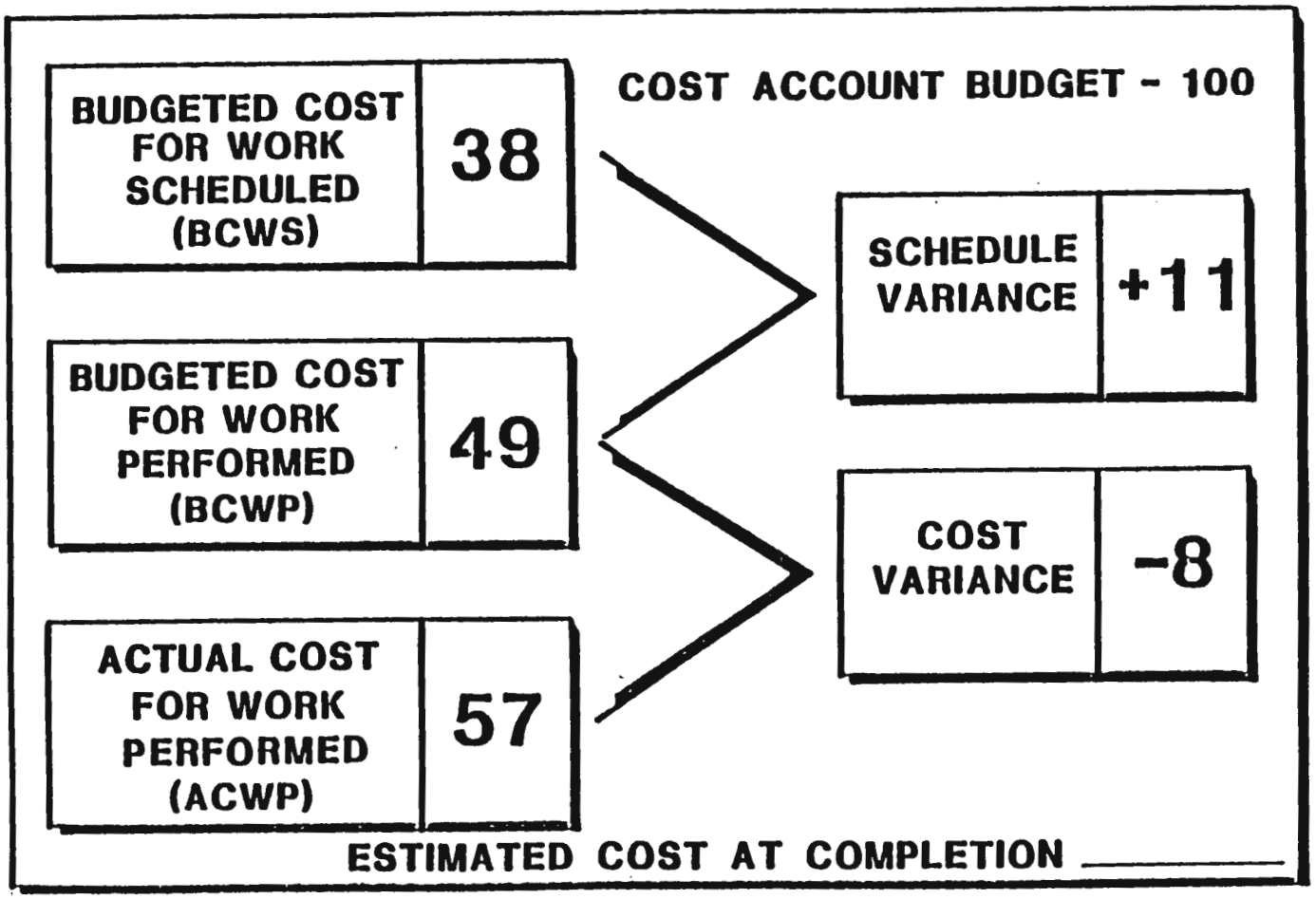
In the foregoing example, the comparison of BCWS and BCWP resulted in a favorable schedule variance (+11). However, when actual costs of work performed (57) are compared with BCWP (49), an unfavorable cost variance results (-8), showing that more money was spent than was planned for the work that was done.

BCWS and BCWP are determined at the cost account level by adding up work package budgets. Actual costs (ACWP) may be collected directly by cost account although it is more common for costs to be collected by work packages or even in more detail. However, all required CSCSC data elements should exist at the cost account level -- BCWS, BCWP, ACWP, schedule variance, cost variance, cost account budget and an estimated cost at completion for the cost account. This information can be used directly by cost account managers and subsequently summarized for higher levels of management and reporting to the Government.

It should be pointed out that unfavorable variances do not always mean poor performance by the people doing the job. The unfavorable cost variance depicted in this example could be attributable to a number of reasons. For example, the favorable schedule variance may have resulted from the use of overtime which in turn created the unfavorable cost variance. Material costs, labor rate changes, poor initial estimates, unrealistic budgets, are other reasons which may account for poor cost performance on a particular job. The main point to be understood, though, is that cost variances can be investigated to determine their causes, and this activity is helpful in gaining a full understanding of contract performance. The contractor should attempt to insure that any practices which might tend to suppress variances (which sometimes occur when all variances are viewed as bad) are not permitted.

ANALYSIS

CSCSC DATA ELEMENTS



COST ACCOUNT

A Key Management Control Point

The requirements for systems integration, data collection, assignment of management responsibility and variance analysis contained in the criteria require a tightly knit and highly structured internal control system. Its effectiveness in operation will depend to a great extent on the disciplines employed within the individual subsystems.

One element of the system stands out as the most significant from a management point of view. The cost account is the main action point for planning and control of contractual effort. Virtually all aspects of the system come together at the cost account including budgets, schedules, work assignments, cost collection, progress assessment, problem identification and corrective actions. Day-to-day management is accomplished at the cost account level. Most management actions taken at higher levels are on an exception basis in an effort to solve the significant problems.

For these reasons, the WBS and functional levels selected for establishment of cost accounts should be carefully considered at the outset of a new contract to insure that the work will be properly defined into manageable units and that functional responsibilities are clearly and reasonably established. The quality and amount of visibility available to a program manager during the performance of the contract will be directly relatable to the level and make-up of the cost accounts.

COST ACCOUNT

A KEY MANAGEMENT CONTROL POINT

- FUNCTIONAL RESPONSIBILITY
- WORK PLANNING AND ASSIGNMENT
- COST COLLECTION
- BCWS-BCWP DETERMINATION
- VARIANCE ANALYSIS
- COST ELEMENT DELINEATION
- CORRECTIVE ACTION
- DATA SUMMARIZATION - WBS/FUNCTIONAL

ANALYSIS

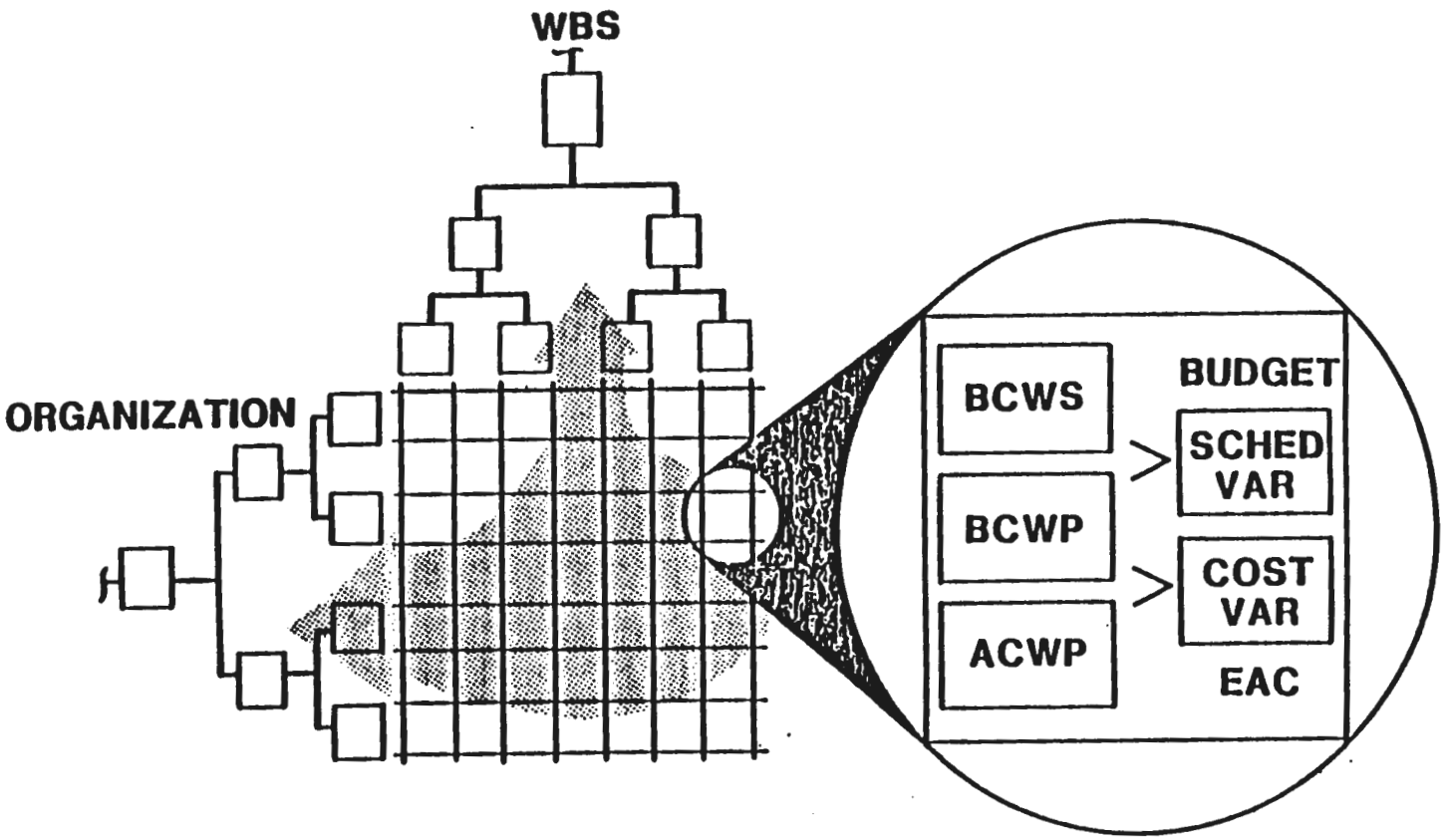
Data Accumulation

As with the collection of actual costs, summarization of all CSCSC data elements should be possible by WBS elements and organizational units. This capability should permit the contractor to evaluate progress in terms of both contract performance or organizational performance. There should be no need for separate contract performance assessments to be made at levels above the cost account since the WBS and organizational structures facilitate the summarization of data for successively higher levels of management.

The DOE Cost Performance Report (CPR) is designed to accomodate this information at the summary level, usually at level three of the WBS and at the total contract level for major functional areas. Ideally, the CPR should be a direct output of the contractor's internal data reporting mechanism, resulting in a format that is useful for both contractor and DOE managers.

ANALYSIS

DATA ACCUMULATION



ANALYSIS

Develop Estimated Costs at Completion

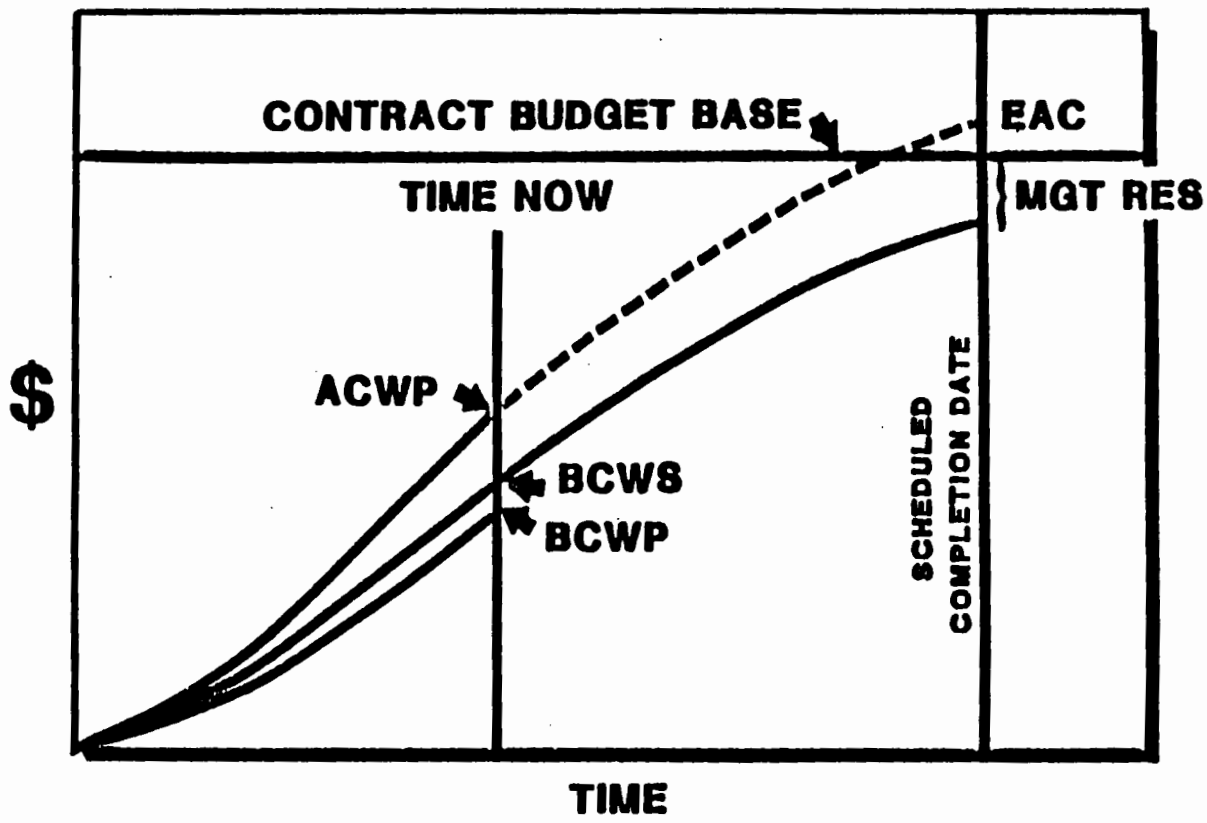
Although the requirements of CSCSC are primarily oriented to obtaining accurate reports of program progress, there is also a requirement for contractors to periodically make estimates of cost at contract completion. Such estimates should be based on performance to date, but should also consider other factors which may affect future performance. The exact methodology for computing estimates at completion is left to the contractor, but the procedure used should be rational and applied consistently from period to period.

The contractor's estimated cost at completion must be reconcilable with the statement of required funds reported to the Government. Estimates at completion may also be reported on other contract cost reports and reconciliation with these estimates should also be possible at the summary level.

It is important to remember, however, that efforts to develop a reasonable estimate must start from a known position and the analysis of prior performance is an integral part of the estimating process. Step one, then, is to be able to establish an accurate position in order to analyze trends and project future costs from a meaningful point of departure. BCWS, BCWP and ACWP provide a meaningful point of departure for estimating final costs.

ANALYSIS

DEVELOP ESTIMATED COSTS AT COMPLETION



RECONCILE EAC WITH STATEMENT OF FUNDS REQUIRED

REVISIONS

Incorporate Directed Changes

Most contracts are changed numerous times during the life of the contract. Changes result from actions initiated by either the contractor or the Government, but are not official until authorized in writing by the Government contracting officer.

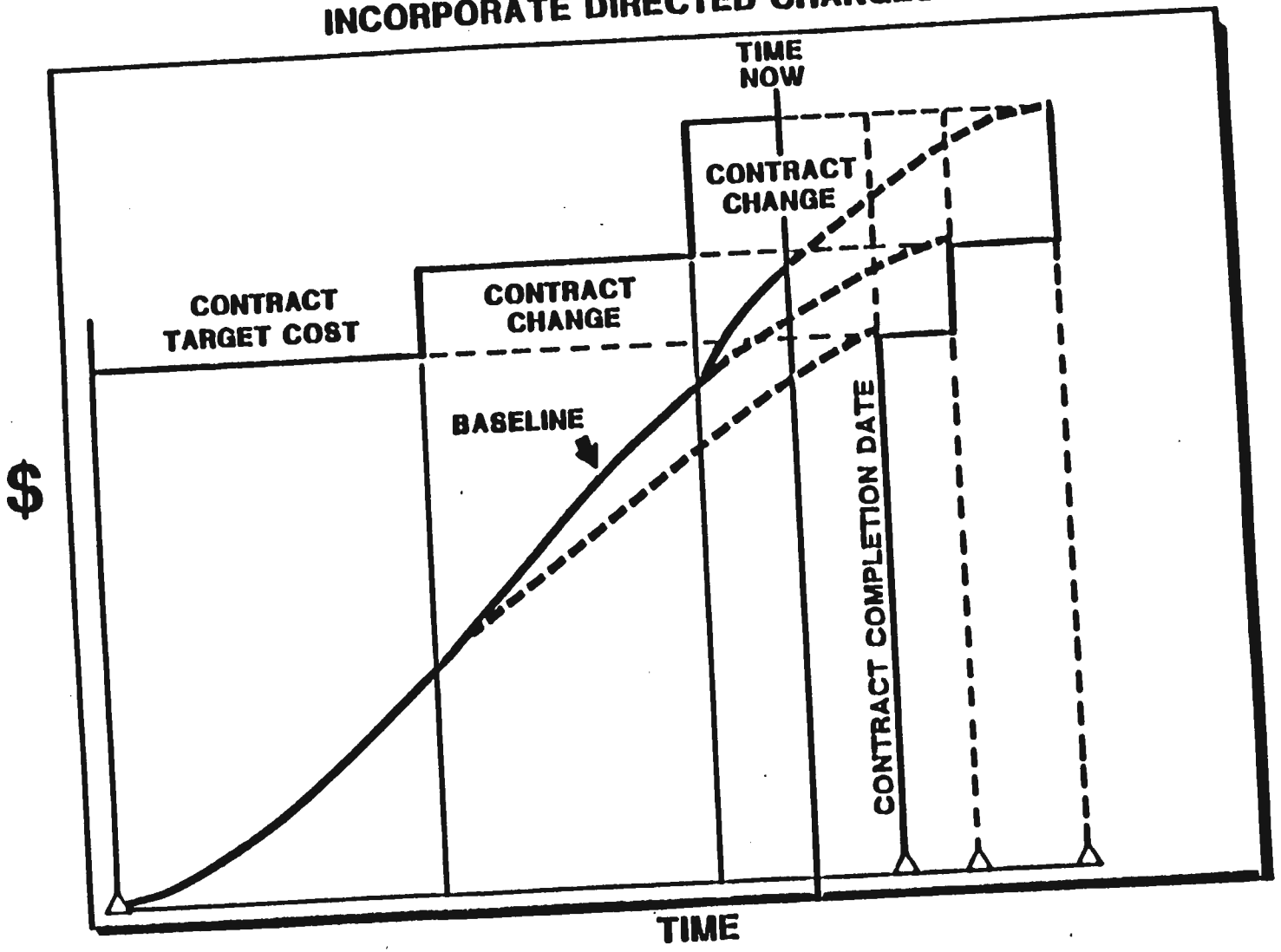
Any contract change which affects the contract cost, schedule or scope of work results in a change to the contract baseline. Format 3 of the Cost Performance Report is designed to reflect baseline changes. Since the Cost Performance Report is intended to portray contract status, contract changes must be incorporated as quickly as possible.

The chart opposite shows how contract changes, which increase the cost and schedule targets, affect the baseline. Other changes could conceivably reduce the scope of the contract or simply change the shape of the curve by rephasing the contractual effort.

Although the baseline should reflect the current contract, it should be possible to track back to the original contract if necessary to see how the contract got to its current state.

REVISIONS

INCORPORATE DIRECTED CHANGES



REVISIONS

Internal Replanning

As with contractual changes, internal replanning actions must be carefully controlled to avoid distorting the measurement of performance. However, it is recognized that management flexibility is also necessary to many internal operations, particularly in a dynamic environment such as engineering development.

The CSCSC provide for a certain amount of flexibility at both the upper and lower levels of management. A management reserve is recognized as a necessary and useful management control tool used by many project managers. Being able to replan work packages within the framework of cost account budgets and schedules provides lower level managers with a degree of flexibility for reorganizing work and people as conditions dictate. More extensive replanning can also be accomodated provided the DOE procuring activity is notified in accordance with established procedures. During these replanning actions, a good general rule to follow is that work and budget should stay together so that budget established for one piece of work is not consumed in the performance of another. Undisciplined transfers of work and budget often cause the performance measurement baseline to lose its effectiveness as a measurement tool.

Retroactive adjustments to records pertaining to budgets or costs of completed work should not be made except for routine accounting adjustments or correction of errors. The criteria also require that the procuring activity be notified whenever a change is made to the performance measurement baseline. Generally, this means that whenever a cost account budget changes for any reason other than a contractual change, notification is required.

REVISIONS
INTERNAL REPLANNING

FLEXIBILITY

- USE MANAGEMENT RESERVE TO CHANGE COST ACCOUNT BUDGETS
- REPLAN UNOPENED WORK PACKAGES WITHIN CONFINES OF COST ACCOUNT
- TRANSFER WORK AND ASSOCIATED BUDGET BETWEEN COST ACCOUNTS
- REPLAN ALL REMAINING WORK

CONSTRAINTS

- AVOID RETROACTIVE CHANGES TO BUDGETS OR COSTS OF COMPLETED WORK
- MAINTAIN ORIGINAL WORK PACKAGE BUDGET ONCE WORK IS STARTED
- KEEP BUDGET TIED TO WORK FOR WHICH IT WAS INTENDED
- NOTIFY PROCURING AGENCY OF SIGNIFICANT REPLANNING ACTIVITY

SUMMARY

Basic CSCSC Requirements

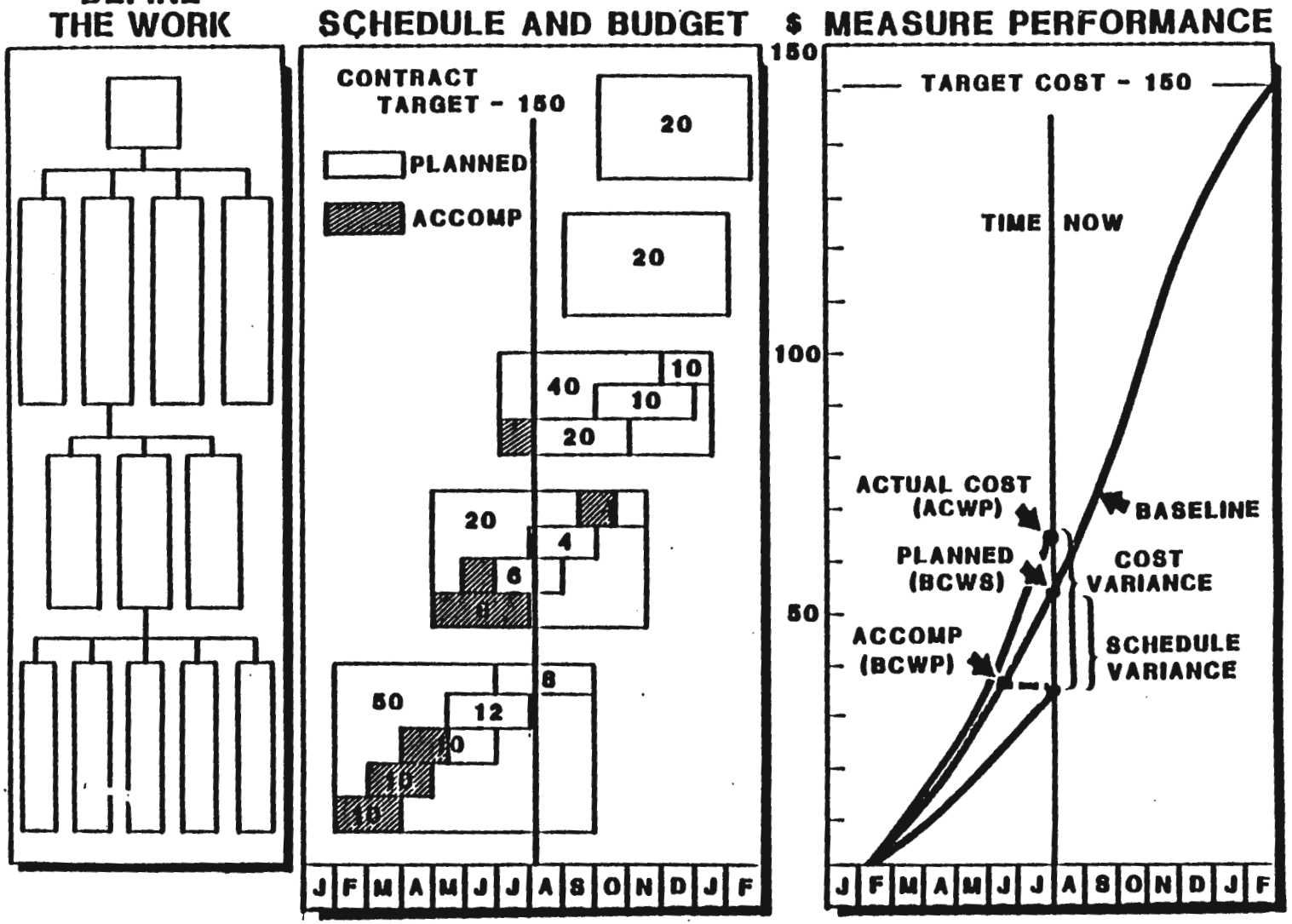
This illustration summarizes the basic concepts and requirements of the CSCSC. The contractor defines the contractual effort using a work breakdown structure as an aid to subdividing and displaying units of work. Scheduling and budgeting the work produces a time-phased baseline which can be used for performance measurement purposes, and which effectively integrates the work, schedule and budget with each other. Since the intent is to measure contract performance, budgets and schedules are oriented to contractual targets.

Contract accomplishment is measured by accumulating the budgets applicable to work performed (BCWP) and comparing them to the budgets for work scheduled (BCWS), and to the actual costs for work performed (ACWP), thereby deriving both schedule and cost variances. Cost status and performance trends can also be used in the development of an estimated cost at completion.

The work breakdown structure provides a useful framework for summarizing performance information for higher levels of management and for reporting to the Government.

SUMMARY

BASIC CSCSC REQUIREMENTS



MOST COMMON PROBLEMS

Based on numerous reviews of contractors' systems during the past few years, certain areas stand out as being the most troublesome in terms of meeting the CSCSC. The four problem areas which appear most frequently are:

1. Inadequate forward planning
2. Lack of objective indicators for measuring accomplishment
3. Undisciplined budgeting practices
4. Baseline maintenance

Where the entire contractual effort has not been identified and defined, the problem of ascertaining total contract status becomes very difficult. It is particularly hard to determine whether more budget has been consumed for the work that has been performed than should have been, because the budget required for the downstream work cannot be identified. Budget baselines in these situations tend to be "front loaded"; i.e., ample budgets are established for the definable near-term work, but inadequate amounts are left for the downstream effort which has not been clearly defined.

Long work packages, without objective indicators for measuring accomplishment, are a common problem, particularly in engineering, where detailed planning is difficult. Use of arbitrary, mathematical formulas for determining BCWP, while effective for short work packages, should be avoided for work packages which are longer than two or three reporting periods. Use of value milestones is an effective technique for longer work packages.

Internal budgeting practices which permit budgets to be shifted from one piece of work to another, or from one organization to another, frequently result in performance measurement distortions which may render the entire system almost useless. The practice of adding budget to a task whenever it becomes obvious that the actual costs will exceed the existing budget, tends to negate the earned value concept, which relies on variances from plan to pinpoint problems and reflect cost performance.

Establishment and maintenance of a valid performance measurement baseline, which is representative of contract accomplishment, is the most basic requirement in a cost performance measurement system. Undisciplined changes to internal budgets and schedules undermines the measurement capability of the system and results in misleading performance reporting, both internally and to the Government.

MOST COMMON PROBLEMS

ORGANIZATION

- INADEQUATE WORK BREAKDOWN STRUCTURE
- POOR WORK DEFINITION AT WORKING LEVELS (WORK PACKAGES)
- INSUFFICIENT FORWARD PLANNING

PLANNING AND BUDGETING

- LACK OF BUDGET DISCIPLINE
- OVER ALLOCATION OF BUDGET
- POOR INTEGRATION OF BUDGET, SCHEDULE, WORK AUTHORIZATION

ACCOUNTING

- INABILITY TO RELATE MATERIAL COSTS TO WORK PERFORMED

ANALYSIS

- DETERMINATION OF STATUS NOT BASED ON OBJECTIVE INDICATORS
- INADEQUATE VARIANCE EXPLANATIONS

REVISIONS

- FAILURE TO MAINTAIN VALID MEASUREMENT BASELINE

CSCSC IMPLEMENTATION

For selected contracts within those projects designated as major system acquisitions or major projects, the CSCSC are placed in the RFP's and eventually in the contracts themselves. Contractors respond to the RFP requirement by describing how their internal cost and schedule control systems meet the criteria, or by referencing a Memorandum of Understanding which certifies prior acceptance of the system by the DOE or other Federal Agencies. CSCSC compliance is a weighted factor which is used in the source selection.

After contract award, the contractors' internal systems are reviewed to verify compliance with the criteria during actual operations. Once validated, it should not be necessary to evaluate the system in-depth thereafter, unless significant changes are made.

Routine surveillance by the cognizant contract administration service and cognizant Federal auditor is performed during the life of the contract to insure continuing compliance and to approve minor system changes.

CSCSC - IMPLEMENTATION

1. REQUIREMENT IN REQUEST FOR PROPOSAL
2. EVALUATION OF PROPOSALS DURING SOURCE SELECTION
3. REQUIREMENT IN CONTRACT
4. IMPLEMENTATION REVIEW
5. READINESS REVIEW
6. DEMONSTRATION REVIEW
7. VALIDATION
8. SURVEILLANCE

SYSTEM REVIEWS

As soon as possible after contract award, a visit is made to the contractor's facility to discuss implementation actions, resolve criteria interpretations, and generally insure that the contractor fully understands the requirement and the review activities which will follow. This is called the implementation review. At this time a tentative date for the demonstration review will also be set.

Approximately two weeks prior to the scheduled date for the start of the demonstration review, a readiness review is conducted. This review usually lasts about one week and is designed to familiarize the demonstration review team with the contractor's operation and to insure that the contractor is ready for a full-scale review. Any deficiencies noted are discussed and, if necessary, the demonstration may be rescheduled until corrective action can be completed.

The demonstration review is a one week in-depth review of the contractor's system. Since the DOE objective is the same as the contractor's, i.e., to get the system validated, the team will discuss problem areas as soon as they are uncovered. Often a correction can be accomplished on the spot or before the team leaves the facility. A thorough exit briefing is performed by the team chief and no surprises should be contained in the team's report.

Surveillance activities begin immediately after contract award. Initial surveillance is usually limited to providing interpretative assistance. After validation, a formal surveillance program can be routinely performed by the site representative, the cognizant Federal auditor, and the project office.

SYSTEM REVIEWS

1. **EVALUATION**

   REVIEW OF SYSTEM PROCEDURES DURING SOURCE SELECTION

2. **DEMONSTRATION**

   REVIEW OF SYSTEM OPERATION AFTER CONTRACT AWARD

   - IMPLEMENTATION REVIEW - TO INSURE COMMUNICATION OF REQUIREMENTS AND DEMONSTRATION PROCEDURES
   - READINESS REVIEW - TO INSURE THAT THE CONTRACTOR IS READY FOR A FULL-SCALE DEMONSTRATION REVIEW

3. **SURVEILLANCE**

   PERIODIC REVIEWS OF SYSTEM OPERATION AFTER CONTRACT AWARD

   - PHASE I - IMMEDIATELY AFTER CONTRACT AWARD
   - PHASE II - AFTER VALIDATION OF SYSTEM

DEMONSTRATION TEAM

The membership of demonstration teams varies from program to program, but is generally the same for all contracts within the same program with the exception of the representatives of the resident site organizations.

Generally, an individual from the Office of Project and Facilities Management will serve as team director. His function is to insure that interpretations of the criteria are consistent and reasonable, and to resolve issues between the contractor and the team that cannot be settled by the team chief. The director also coordinates the final report at the headquarters.

The team chief is responsible for directing the team's activities during all phases of the review. He correlates team members inputs and is responsible for issuance of the final report.

Team members are assembled from the various functional areas involved with the program. Ideally, teams are composed primarily of those individuals who will work on the project throughout its lifetime. This approach provides many benefits to both the DOE and the contractor, particularly in terms of improved communications.

DEMONSTRATION TEAM

- **TEAM DIRECTOR**
  - — OFFICE OF PROJECT AND FACILITIES MANAGEMENT
- **TEAM CHIEF**
  - — OPFM - PROGRAM OFFICE - PROJECT OFFICE
- **TEAM MEMBERS**
  - — PROGRAM OFFICE
  - — PROJECT OFFICE
  - — FIELD OFFICE
  - — COGNIZANT FEDERAL AUDITOR
  - — OTHER SPECIALISTS AS REQUIRED

BENEFITS TO PROGRAM/PROJECT OFFICE

A number of benefits are derived as a result of the criteria approach, particularly as a result of the demonstration review process. Government representatives gain a good working knowledge of contractor operations, procedures and terminology, leading to better communications with the contractor as well as inspiring greater confidence in contractor-generated cost information.

The work package approach to measuring contract status provides for considerably more objectivity in the assessment of actual work accomplishment than many performance measurement approaches used in the past.

Formal variance analyses and the capability to trace problems to their source, facilitate early visibility of unfavorable cost trends, and factors creating program difficulties are highlighted.

Analysis of schedule conditions in terms of cost impact is a valuable management control tool. Correlating CSCSC schedule variances with the outputs of the formal scheduling system permits a cross-check on the validity of the Budgeted Cost for Work Performed and associated cost variances.

Perhaps the most important benefit, from the Government's point of view, is that contract performance is being measured against a formal, contract-related baseline, rather than against a contractor's internal operating plan, which may represent something other than the contractual commitment.

BENEFITS TO PROGRAM/PROJECT OFFICE

CSCSC PROVIDES:

1. CONFIDENCE IN CONTRACTOR'S INTERNAL MANAGEMENT SYSTEM
2. OBJECTIVE (RATHER THAN SUBJECTIVE) CONTRACT STATUS INFORMATION
3. COST IMPACT OF KNOWN PROBLEMS
4. IDENTIFICATION OF PROBLEMS NOT PREVIOUSLY RECOGNIZED
5. CAPABILITY TO TRACE PROBLEMS TO SOURCE (WBS AND ORGANIZATION ELEMENTS)
6. QUANTITATIVE MEASURE OF SCHEDULE DEVIATION IN DOLLARS
7. MEASUREMENT AGAINST A CONTRACT ORIENTED BASELINE

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