Depicting Schedule Margin in Integrated Master Schedules

National Defense Industrial Association
Program Management Systems Committee
Schedule Working Group

FORWARD

The objective of this paper is to discuss practices for depicting Schedule Margin in Integrated Master Schedules and project schedules and to communicate recommendations for revising related guidance and direction to incorporate these best practices. The scope of the discussion is limited to the techniques of depicting Schedule Margin in project schedules. The two most common methods to depict Schedule Margin in the schedule are the use of buffer tasks and the creation of deadlines that are earlier than contractual milestones. Techniques for quantifying Schedule Margin are referred to when they are germane to the topic but are not the focus of this paper and are discussed only as necessary.

Terms used interchangeably in this paper:	Schedule Margin and Schedule Reserve*.*
	Integrated Master Schedule (IMS) and Schedule
	Program and Project

BACKGROUND

The formal identification of Schedule Margin is a relatively recent concept in program and project management. It arose in the late 1990s out of two areas of thought and practice. The first is the Theory of Constraints, which proposes in every system, at any given point in time, there exists one constraint that limits the system throughput. This was followed by the Critical Chain Method (CCM)[1] which provides a technique for a more efficient scheduling approach and more effective task level execution management through identification and management of constraints. CCM is compared to the more typical Critical Path Method (CPM), which contributes to effective project management through the identification and analysis of the longest duration path through a network of interdependent activities. The focus of CPM is on task order and scheduling contrasted with the CCM focus on constrained resources. The second area is Schedule Risk Analysis (SRA), which has evolved from the PERT /TIME technique used on the U.S. Navy Polaris program in the early 1960's. Both of these current methods employ techniques that specifically identify time margins as critical components of program management. CCM and SRA are in widespread, although not ubiquitous, use throughout the project management community, including organization that also report Earned Value Management (EVM) metrics.

The relative parallel evolution of both CCM and SRA has resulted in ambiguity regarding the appropriate manner in depiction of Schedule Margin in the schedule, whether as a task with

[1] See Appendix A for a brief summary of both the critical chain method (CCM) and the critical path method (CPM).

duration but no scope or resources or the delta between a risk-adjusted deadline and a specified contractual constraint. This ambiguity arises from the multiple uses of the schedule by the project's various stakeholders. Project Managers use the schedule as a management tool that facilitates effective management and control of a project or program. Other stakeholders (including customers and oversight organizations) use the schedule as a means to verify the realism and efficacy of the project plan. The project management community recognizes that Schedule Margin is an effective risk mitigator and is used to manage and control the project. While the CCM concept depicts margin as buffer tasks in the schedule, some organizations have a differing view and assert that Schedule Margin should be identified as deadlines in front of contractual milestones (constraints).

Federal Government References to Schedule Margin

Schedule Margin has been defined slightly differently by two major agencies of the federal government: National Aeronautical and Space Administration (NASA) and the Department of Defense (DoD). Their methods are described briefly below.

National Aeronautics and Space Administration.

Margin as defined by the *NASA Space Flight Program and Project Management Requirements, NPR 7120.5:*

> *The allowances carried in budget, projected schedules, and technical performance parameters (e.g., weight, power, or memory) to account for uncertainties and risks. Margin allocations are baselined in the formulation process, based on assessments of risks, and are typically consumed as the program/project proceeds through the life cycle.*

The *NASA Schedule Management Handbook* (Draft 14 Oct 2006) also discusses Schedule Management Reserve in 5.2.6:

> *Schedule management reserve is used for future situations that are impossible to predict (just in case time for unknown unknowns). It is a separately planned quantity of time above the planned duration estimate specifically identified in the schedule as "Schedule Management Reserve" and is intended to reduce the impact of missing overall schedule objectives. This type of reserve must be inserted into the IMS at strategic locations so that it satisfies its intended purpose as overall schedule management reserve for the project completion. To ensure this, it is recommended that this type of reserve be placed at the end of the IMS network logic flow just prior to hardware delivery or whatever the appropriate project completion task/milestone might be. Other example locations for this type of reserve might include placement just prior to PDR and CDR.*
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> *PDR is Preliminary Design Review; CDR is Critical Design Review.*

The *NASA Schedule Management Handbook* also discusses the identification of schedule reserve in the schedule in section 7.2.6, *Schedule Reserve Assessment:*

> *Schedule reserve should be easily identifiable and strategically placed within the IMS. Generally, it is recommended to create specially labeled tasks for schedule reserve and place the bulk of reserve at the end of the schedule just prior to project completion so that it will be reflected and easily accounted for and managed as part of the critical path sequence. Other smaller blocks of schedule reserve could also be associated with significant key events in the IMS and placed logically just prior to those events.*

It is also related to critical path in 7.2.3*, Critical Path Identification and Analysis:*

> *The schedule may become very dynamic during the implementation phase, and because of this, it is imperative to always know what sequence of tasks is the real driver affecting project completion. It is also important to monitor the consumption of schedule reserve that may exist as part of the critical path. Management insight into the critical path is essential in making accurate resource and manpower decisions to successfully achieve project completion.*

The above extracts make clear that NASA intends for schedule reserve to be specifically identified as a task with durations, but without defined scope, in the schedule and to be included when the critical path is calculated.

Department of Defense

In the Department of Defense, Schedule Margin is primarily discussed in *DI-MGMT-81650* paragraph *2.4.1.22,* which states that Schedule Margin is*:*

> *. . . a management method for accommodating schedule contingencies. It is a designated buffer and shall be identified separately and considered part of the baseline. Schedule margin is the difference between contractual milestone date(s) and the contractor's planned date(s) of accomplishment.*

DI-MGMT-81650 correctly defines Schedule Margin as a buffer and stipulates that it is considered part of the baseline. Use of the word "baseline" in *DI- MGMT-81650* is somewhat ambiguous because it could be construed to be another baseline such as the Acquisition Program Baseline (APB). The assumption is that the "baseline" as described in *DI- MGMT-81650* refers to the Performance Measurement Baseline (PMB). However, the term "PMB" may not be used because the Integrated Master Schedule (IMS) is sometimes required when EVM is not a requirement and the use of the term PMB in the absence of EVM may be inappropriate.

The second part of the *DI- MGMT-81650* definition identifies Schedule Margin as the difference between contractual milestone dates and the contractors planned date of accomplishment. This could imply that margin may also be a period of time between two milestones that is simply white space rather than a named element. This method also would result in acceptable margin (given that it was arrived at through a schedule risk assessment), however, this method complicates schedule management practice, increases the usage of imposed dates/constraints, and reduces the Program Manager's overall ability to locate, quantify, and manage his/her Schedule Margin*.* This is true in the Gantt View and especially when viewing solely the data and columnar fields of the majority of schedule management toolsets.

DISCUSSION

Purpose of the Project Schedule (Integrated Master Schedule)

The primary purpose of a project schedule is to provide a roadmap for how and when the project will deliver its products and/or capabilities. Because plans are not perfect, the schedule is a living plan that will evolve over time as a consequence of change, which is a constant in all projects. Managing this change with respect to the program baseline is essential.

The Office of the Secretary of Defense (OSD) Acquisition, Technology, & Logisitcs (AT&L) *Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide* provides the following view of the schedule:

> *A comprehensive IMS used to manage the program on a daily basis. It is normally provided by the contractor via a Contract Data Requirements List (CDRL) item. It is updated on a regular basis. It should contain all of the contract IMP events, accomplishments, and criteria from contract award to completion of the contract . . .* [Page 5]

It is clear that OSD AT&L recognizes that the IMS is a tool used by project managers to help manage and control the project. The schedule tells them what they need to do every day; what is important; what resources must be applied and when. The schedule helps them make decisions when faced with unplanned events that affect the project. Without the roadmap visibility the schedule provides the project manager can only guess what to do and how to react to unplanned events. The schedule does have a second purpose in that it is an artifact that documents and demonstrates the adequacy of the project planning and (when routinely statused) the performance of the project against the plan. The schedule is commonly provided to internal and external stakeholders and customers who analyze the schedule to provide confidence in the plan and assurance of satisfactory performance against the plan.

Stakeholders influence the schedule by establishing constraints such as major milestones that reflect the project objectives and through specific format and content requirements for the schedule such as is contained in *DI-MGMT-81650, Integrated Master Schedule.*

The method employed by a particular project must be based upon the established project methodology and process employed by the performing organization in order to be effective as a management tool. Given multiple methods that are equally effective in achieving the same outcome, the method should be based on the experience, competence and preference by the performing organization responsible for developing and maintaining the schedule as well as managing the project. To do otherwise may cause inefficient management or additional work to maintain a vital artifact and tool necessary for effective project management. Mandating specific methodologies not only may increase cost but also is contrary to the principles of performance-based acquisition. The understood caveat is the equal validity of both the milestone and buffer task method of depicting Schedule Margin in the IMS. As long as both methods provide the necessary information for both management and analysis by stakeholders, then it should be the responsibility of the organization that manages the activities contained in the schedule to apply their internal business practices for determining and depicting Schedule Margin.

It is necessary and vital for stakeholders, especially the federal government, to exercise oversight and insight into the contractor's planning, management, and performance. However, the responsibility for the planning and management resides with the contractor including company practices for identifying Schedule Margin in the IMS.

Schedule Margin

Schedule Margin is a management method to mitigate the consequences of imperfect planning and execution. With perfect knowledge and foresight, a project manager could identify all the tasks, resources, interfaces, external events, interdependencies, and even predict future conditions that would facilitate the creation of a perfect schedule. Of course, knowledge is imperfect and highly accurate forecasting is impossible. Consequently, schedules account for imperfection through the identification of risks, Schedule Risk Analysis, and the inclusion of Schedule Margin in the integrated master schedule to plan for schedule perturbations due to unforeseen, in-scope issues.

Schedule Margin is identified and controlled blocks of time inserted into the network of program schedules to facilitate achieving program objectives/contract requirements that are part of a program's critical path(s). Schedule Margin is to be used solely as schedule risk mitigation. As such, it is only to be utilized to accommodate unforeseen in-scope issues that have the potential to threaten achievement of program objectives if not properly and proactively addressed. Schedule Margin is expressed in the same units of time as the activities/tasks.

The amount of schedule time assigned to the duration of the Schedule Margin activity/task is networked into the path to ensure Total Float/Slack is a calculated value rather than constrained and driven to "zero" by being hidden in individual tasks. It is clear that if the duration of the Schedule Margin activity/task is reduced to zero, the Total Float/Slack value of the corresponding network chain will increase commensurate to the amount of duration usurped.

Schedule Risk Assessments (SRAs) and Schedule Margins are closely related. A Schedule Risk Assessment is employed to predict the probability of project completion within the constraints established for a project. An SRA is conducted at the beginning of a project and periodically throughout the project lifecycle. Three-point duration estimates (best case, worse case, and most likely) are conducted for tasks or activities in the schedule. For large projects, estimates may not be accomplished for all activities, but at a minimum should be conducted for activities on the critical path and for all high-risk activities in the program. The result is the probability of successfully meeting the schedule dates and the key (contractual) project dates. Project staffs use these estimates to insert Schedule Margin (including feeding buffers and project buffers) to control change to the critical path and increase the likelihood of completing the project on time.

Depicting Schedule Margin in the IMS is a consequence of the management process that the performing organization determines is necessary to effectively manage schedule risk. In projects and programs where there is significant complexity and concurrency, the critical path should be protected to promote program stability. For these types of projects and programs, Schedule Margin should be identified and depicted as defined buffer tasks that are expected to be consumed. In less complex projects with fewer dependencies and concurrent activities, Schedule Margin may be consolidated into early milestones in advance of contractual milestones. The decision to employ one or both methods is a result of an organization's business and management practices as well as the complexity and risk in a project.

Depicting Schedule Margin as a Buffer Task

The critical path in a schedule is based upon the durations for all activities when the schedule is initially developed. As the work progresses some activities will take longer than planned, for a number of reasons; but few activities, if any, will be shorter than planned. Additionally, activities yet to occur may be replanned as an outcome of analysis, performance information, or natural changes in every program. As the durations change, the critical path and critical path length may change. The change in the critical path then affects downstream milestones, which in turn may cause change to upstream activities to compensate. The consequence of this change is a constant challenge to adjust activities and durations to fit within the constraints and compensate for critical path changes. The result often resembles an analog feedback loop creating an oscillation effect where change causes still more change ("today's critical path is…"). Critical Path variability can be managed by quantifying Schedule Margin through Schedule Risk Analysis and establishing buffer tasks either in the critical path or on non-critical path nodes before they enter the critical path. The use of buffer tasks reduce schedule perturbations and increase schedule stability by protecting the critical path from perturbations in non-critical tasks, as shown in Figure 1.

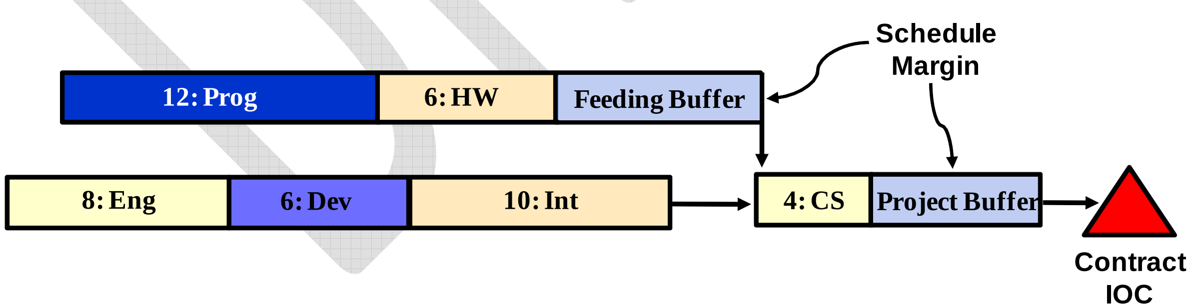

Figure 1 Project Schedule Placement of Schedule Margin in Feeding and Project Buffers

Depicting Schedule Margin as an explicit activity/task has significant benefits in that margin is readily identifiable; as such, it is directly manageable and Program Management (PM) "ownership" can be maintained or selectively delegated. If excluded from the margin activity/task duration, Schedule Margin effectively is "lost" to Control Account Managers (CAMs) and relegated to the Total Float/Slack value. The explicit buffer process also provides the ability to easily monitor margin erosion (per *DI-MGMT-81650, 2.4.1.23.2).* Rather than Schedule

Margin being invisibly included in the Total Float/Slack value, buffer tasks provide immediate visibility in the movement of a path's end date. This visibility permits overt action to reconcile potential impacts to schedule and promotes intervention with smaller schedule perturbations. The use of buffer tasks easily can be "converted" to Total Float by zeroing-out duration of margin nodes prior to performing Schedule Risk Assessments (SRAs).

Depicting Schedule Margin Using Milestones

Early constraint milestones that recognize critical path uncertainty and risks also may be used at points prior to contractual milestones to create a buffer to ensure that the contractual milestones can be met. Planning schedules that aggressively schedule activities at the lower end of the confidence interval establish Schedule Margin using the time difference between the best case finish date and the contractual finish date as a reserve. This should be accomplished using Schedule Risk Analysis techniques to ensure that there is a rational basis for the early finish dates. This use of the best-case schedule would not contain any buffer tasks because the reserve/margin would be depicted by the difference between the early finish milestone and the contractual milestone as shown in Figure 2.

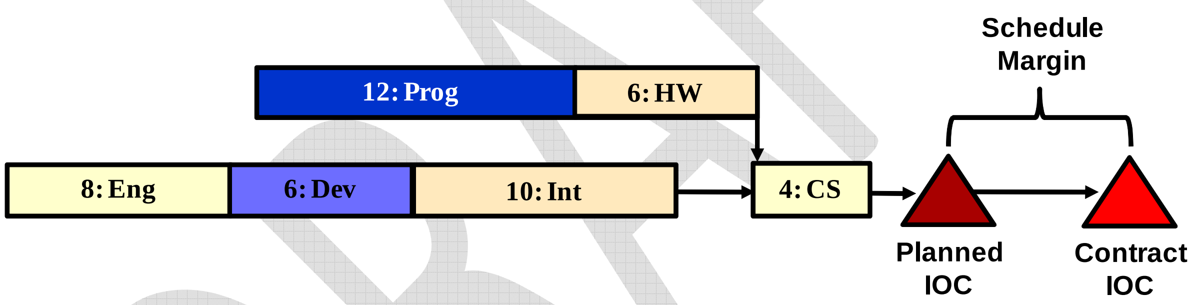

Figure 2 Project Schedule Placement of Schedule Margin Using Milestones

A challenge schedule also may incorporate early incremental milestones. When contractual milestones are relatively few, the Schedule Margin created using the difference between early milestones and contractual milestones, while adequate, is not as managerially effective as a schedule with margin created using both feeding and project buffers. One of the detrimental aspects of using the milestone method against contractual milestones is the excessive use of constraints in the schedule.

Accommodating Schedule Margin in Schedule Performance Analysis

Schedule analysis is a key activity in project management for both the performing organization and the stakeholders. While there are analytical tools which facilitate analysis (i.e. Schedule Performance Analyzer), analysis itself is conducted by human beings who interpret and analyze data and information. The project manager needs to analyze the schedule to assess the adequacy of resources and budgets; to assess performance and take action when warranted; to re-plan when there are unanticipated impacts to the project; and to conduct "what if" scenarios in order to respond to risks and opportunities. In short, the schedule is the primary planning and management tool in the project manager's arsenal. Once developed, validated, and in use, schedule performance analysis becomes the primary purpose for, and use of, the schedule. Schedule Margin should be removed prior to performing schedule analysis, particularly Schedule Risk Analysis (SRA).

Without the insight provided by clearly identifying remaining Schedule Margin, critical path analysis, margin analysis, and others types of analyses contain unquantifiable uncertainty. Safety time that is embedded in individual task durations (equivalent to hidden Schedule Margin) makes it nearly impossible to make solid analytical decisions because such hidden margin cannot be removed prior to performing Schedule Risk Analysis (SRA).

The visibility into Schedule Margin for analysis has many advantages over analysis where the margin is not visible. While the usefulness of visible Schedule Margin buffer tasks is evident, there are methods of excluding buffer tasks when analyzing the schedule. One method would be to set all buffer task durations to zero. Another would be to filter out buffer tasks. The key benefit of visible buffers in schedule analysis is that it contributes to better analysis, control, and management. Additionally, Schedule Margin easily can be zeroed prior to performing Schedule Risk Analysis (SRA).

The Schedule Working Group has spent considerable time discussing the impact of Schedule Margin on various individual metrics. A brief summary of the group's discussion of two metrics, the Baseline Execution Index and the Critical Path Length Index are included here.

Baseline Execution Index

A specific metric applied in schedule performance analysis is the Baseline Execution Index (BEI). The BEI is simply the ratio of tasks actually completed to the tasks, which were planned (baselined) to be completed. It is an index that demonstrates the efficiency at which tasks are being completed.

Using buffer tasks might have some impact on this metric because under ideal conditions, the project will complete on time with buffers almost fully consumed. Buffer consumption could slightly distort the BEI ratio because all buffers may not be consumed (buffer task not complete) as planned. This can be readily handled during analysis simply by filtering out all buffers, just as you would for all non-discrete activities (such as LOE tasks) prior to generating the BEI.[2]

However, there are arguments that filtering out (or zeroing) buffers might also distort BEI. For these arguments, there are three responses that mitigate any significant distortion.

First, buffers naturally disappear. Whether this is due to erosion of their duration value in mitigating critical path degradation or whether it is due to performing all prerequisite tasks with residual buffer duration (and thus completing the buffer so that successors can be accelerated)

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[2] Buffer task consumption could also be measured similar to the BEI in that an analyst could relate buffer consumption to planned buffer consumption, providing insight into schedule variability and aggressiveness.

does not matter. Much like SPI which eventually equals 1.0, buffers by their nature are eventually consumed or eliminated.

Second, buffer consumption does NOT distort BEI. Tasks (and margin windows or buffers) are scheduled to start and complete on given dates. Those dates are when we officially expect to start or complete. If we fail to start or complete (for whatever reason and especially not because we have decided to reduce the margin window duration to accommodate the expansion of predecessor tasks) we are experiencing a slip to our original plan. As such, BEI quite correctly should (and will) reflect this slippage.

Third, by filtering out or zeroing the buffer(s), all downstream tasks (beyond the buffers) will appear to need to execute PRIOR to its baseline execution plan (since the buffers have all been removed and the forward pass will quite naturally and correctly move everything appropriately to the LEFT without the presence of the buffer duration holding everything in its baseline position). Since the BEI is concerned with completed tasks, the movement of future tasks for purposes of calculation of the BEI will not affect the project baseline and should not have any adverse effect.

Critical Path Length Index

Another metric used on federal government projects is the Critical Path Length Index (CPLI), which is the longest, continuous sequence of tasks through the network from the start (or current status date) to completion. The CPLI is the Remaining Critical Path Length (in workdays) plus the Total Float (including margin), divided by the Total Critical Path Length (in workdays). Because Critical Path Length is an element of both the numerator and the denominator, so long as the buffer is consistently included or excluded in both the numerator and denominator, it has no effect on the ratio.   Additionally, a benefit of feeder buffers is to shield the critical path from change caused by task slippage, thereby reducing CPLI variability over time.

CONCLUSIONS

1. Establishing Schedule Margin in relation to contractual milestones mitigates the consequence of variability by creating a time buffer that allows for perturbations and delays. Critical Path elongation is mitigated by consumption of margin. The milestone method for incorporating Schedule Margin, such as found in challenge schedules, is a valid method, but does not prevent perturbations to the critical path or eliminate hidden buffers and therefore complicates schedule management practice and limits practical use of Critical Path Methodology.

2. Buffer tasks inserted at strategic points in the schedule, such as on nodes entering the critical path, serve to protect the critical path (and critical chain in CCM) from

perturbation in non-critical tasks. Essentially, buffer tasks serve to decrease change in the critical path through buffer consumption.

3. The definition of Schedule Margin in *DI- MGMT-81650* is ambiguous because it identifies margin both as a buffer and as the difference between milestone dates. The word “buffer” appears to be intended as a cushion rather than a buffer task. Because the definition specifically refers to contractual dates, it seems to prohibit margin that is not referenced to contractual milestones. This is in conflict with the guidance found in the *NASA Scheduling Handbook* and accepted practice throughout the project management industry.

4. Schedule Margin in the form of buffer tasks have a beneficial effect on schedule analysis by permitting the analysis to be conducted on a risk-based schedule with visible, rather than hidden, buffers. Because buffers are visible, it is simple to filter the buffers to facilitate analysis without them. In addition, the visibility of buffers provides an opportunity for increased insight and proactive adjustments by monitoring buffer consumption.

RECOMMENDATIONS

1. *Revise **DI-MGMT-81650** to clarify the acceptability of the use of buffer tasks.*
2. *Revise industry standards, such as the **Earned Value Management Implementation Guide (EVMIG)**, to adequately address both cost and schedule elements of Management Reserve (MR).*

Appendix A

Critical Chain Method (CCM)

First introduced by Eliyahu M. Goldratt in 1997, Critical Chain is based on methods and algorithms derived from the Theory of Constraints. The critical chain is the longest path through the project, considering both task and resource dependencies. Underlying CCM is the recognition of the impact of variation (the statistical nature of projects) and of human behavior (response to how their projects are managed). The established approaches to statistical variation in any activity tend to ignore *Parkinson's Law* (that work expands to fill the time available for its completion) and the *Student Syndrome* (where work is delayed until the last possible moment). The net result of this is that delays are passed on and gains are not. One element of CCM that contributes to protecting the project from variability is the feeding buffer. Feeding buffers are determined quantities of time that are inserted at the nodes where non-critical tasks and chains merge with or feed critical tasks. The role of the feeding buffer is simply to protect the critical chain from variation in non-critical chains of tasks. Even though Schedule Margin windows have been advocated in CPM scheduling, such buffers are not an inherent component of the Critical Path Method (CPM) as they are in CCM.

Dependencies used to determine the critical chain include both predecessor and successor dependencies, as well as resource dependencies. The identification of the critical chain uses a network of tasks with aggressive, but achievable estimates, which is first resource leveled against the available resources

The key components of a critical chain schedule

- "Safe" task times adjusted to aggressive but possible task durations[3]
- Use of both task and resource dependencies in identifying the critical path (called the critical chain)[4]
- Aggregating task variability into feeding and project buffers to protect due dates from the effects of task completion variations
- Monitoring buffer consumption to determine task priorities and schedule recovery actions

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[3] Robert Austin in "The Effects of Time Pressure on Quality in Software Development: An Agency Model," (*Information Systems Research*, Vol.12, No. 2, June 2001, pp 195-207) states that ". . .costs can be minimized by adopting policies that permit estimates of completion dates and deadlines that are different and harmful 'shortcut-taking' can be eliminated by setting deadlines aggressively, thereby maintaining or even increasing the time pressures under which developers work."

[4] If there is no contention for resources, the critical path and critical chain are identical.

Figure 1 on page 6, modified to comply with the above key components, would have the same delivery date as the schedule shown in Figure 2 (page 7), but would allocate task times differently. A revised CCM schedule is shown in Figure A.1.

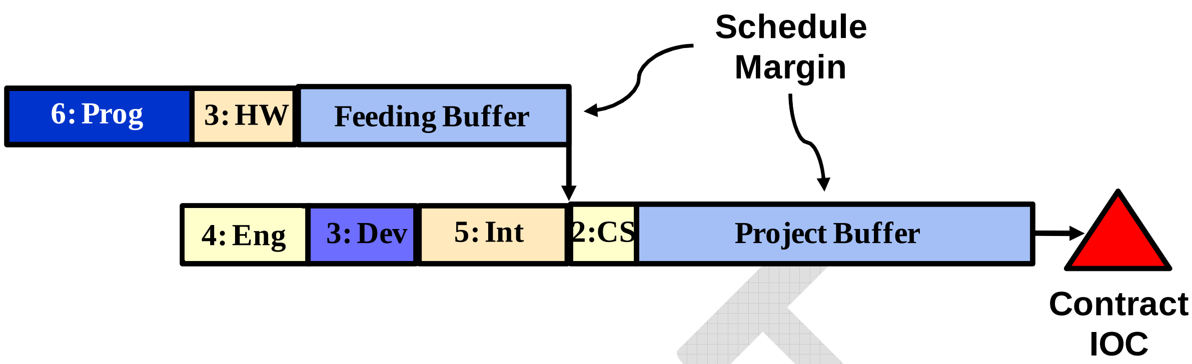

Figure A.1 Project Schedule Showing Aggressive, But Possible, Task Durations

The specific method employed in CCM is to establish buffer tasks that have duration without budget or resources. As the project progresses, tasks that take longer than planned consume the (feeding or project) buffer. Tasks that require less than the time planned, recover buffer time. Project staff monitors the consumption and takes action as appropriate, similar to monitoring Management Reserve utilization in EVM. CCM does not replace responsible management at the Control Account and Work Package level; rather it is a metric that provides additional insight into setting priorities and dealing with uncertainty.

Critical Path Method (CPM)

Critical Path Method is a network analysis technique used in complex project plans with a large number of activities that identifies all activities; the duration of each activity and the relationship of each activity to its predecessor and successor thus creating a network. Any given sequence through the network is a path and the longest-path in the network is the critical path. It is 'critical' because all activities on it must be completed in the designated time, otherwise the project end date will be delayed.

CPM was developed in 1957 by the DuPont Corporation at about the same time that General Dynamics and the US Navy were developing the Program Evaluation and Review Technique (PERT). Today, it is commonly used in projects with interdependent activities to calculate the critical path.

The critical path is defined as the longest contiguous path of discrete tasks/activities having the least amount of Total Float or Total Slack, thus defining the minimum duration of the project. The activities on the critical path have the least amount of float. Total Float/Slack is a calculated value that indicates the amount of time a contiguous path of activities/tasks can be delayed before affecting the identified completion date of that particular path. Total Float/Slack is the calculated difference between when an activity/task can occur (e.g. Early Finish) and when an activity/task must occur (Late Finish). Free Float/Slack is the calculated value that indicates the amount of time a single activity/task can be delayed before its successor activity/task is impacted. CPM calculates the longest path of planned activities to the end of the project, and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are critical (i.e., on the longest path) and which have float and can be delayed without making the project longer. This determines the shortest time possible to complete the project. Any delay of an activity on the critical path directly impacts the completion date of the project. In complex projects, CPM provides a means to focus on the path(s) that are most “critical” in that there is no room for delay with respect to infringing upon program commitments.

The ability to prioritize tasks and adjust the critical path by adding resources or increasing concurrency is a key contribution to effective project management by the CPM. As originally developed, CPM considered only logical dependencies between elements because finding the critical path considering both tasks and resource availability was mathematically difficult. However, most CPM algorithms now level resources. This trend has lessened the differences between CPM and CCM. However, the use of aggressive task times and buffers to handle task completion uncertainty remains a key distinction between the two methods. Although there are no procedural or practice constraints to the inclusion of margin buffers in CPM, it is not a recognized attribute of the method as it is in CCM.