



College of Performance Management

IPMW 2014

Schedule Margin

(...err Buffer, I mean Reserve, umm...Contingency)

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Standard Guidance

IPMR DID

- [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.

IPMR Implementation Guide

- Schedule **margin** (aka schedule **contingency**, **buffer**, **reserve**, or any other term which meets this definition) is any task not associated with specific scope or resources, and is used to increase the probability of on-time completion of the contract events.

PASEG

- Program teams can establish schedule **margin** by creating a **buffer** prior to an end item deliverable or any contract event. The time allotted in this **buffer** can be used to offset unforeseen issues identified during program execution.

Standard Guidance

GAO Schedule Assessment Guide

- A baseline schedule should include a buffer or a **reserve** of extra time, referred to as schedule **contingency**, to account risk....
- ...the baseline schedule should include a **buffer** or **reserve** of extra time.
- A Monte Carlo SRA simulation could have helped identify the compound effect of parallel paths and could have quantified how much **contingency reserve** or **buffer** was needed in the schedule to mitigate the risk.
- ...**contingency** represents time...for “unknown unknowns” ...
- Schedule **reserve**...is for “known unknowns” ...
- *We recognize that other organizations may define the terms schedule **contingency**, schedule **reserve**, schedule **buffer**, and schedule **margin** differently.*

What if...

what *if*... terms like Schedule Margin, Reserve and Buffer had clear and unique definitions?

what *if*... their durations were not subjective, but instead were precisely calculated ?

what *if*... they were consistent with their more well established “cost” counterparts?

what *if*... these definitions and formulas were standard across all of government and industry?

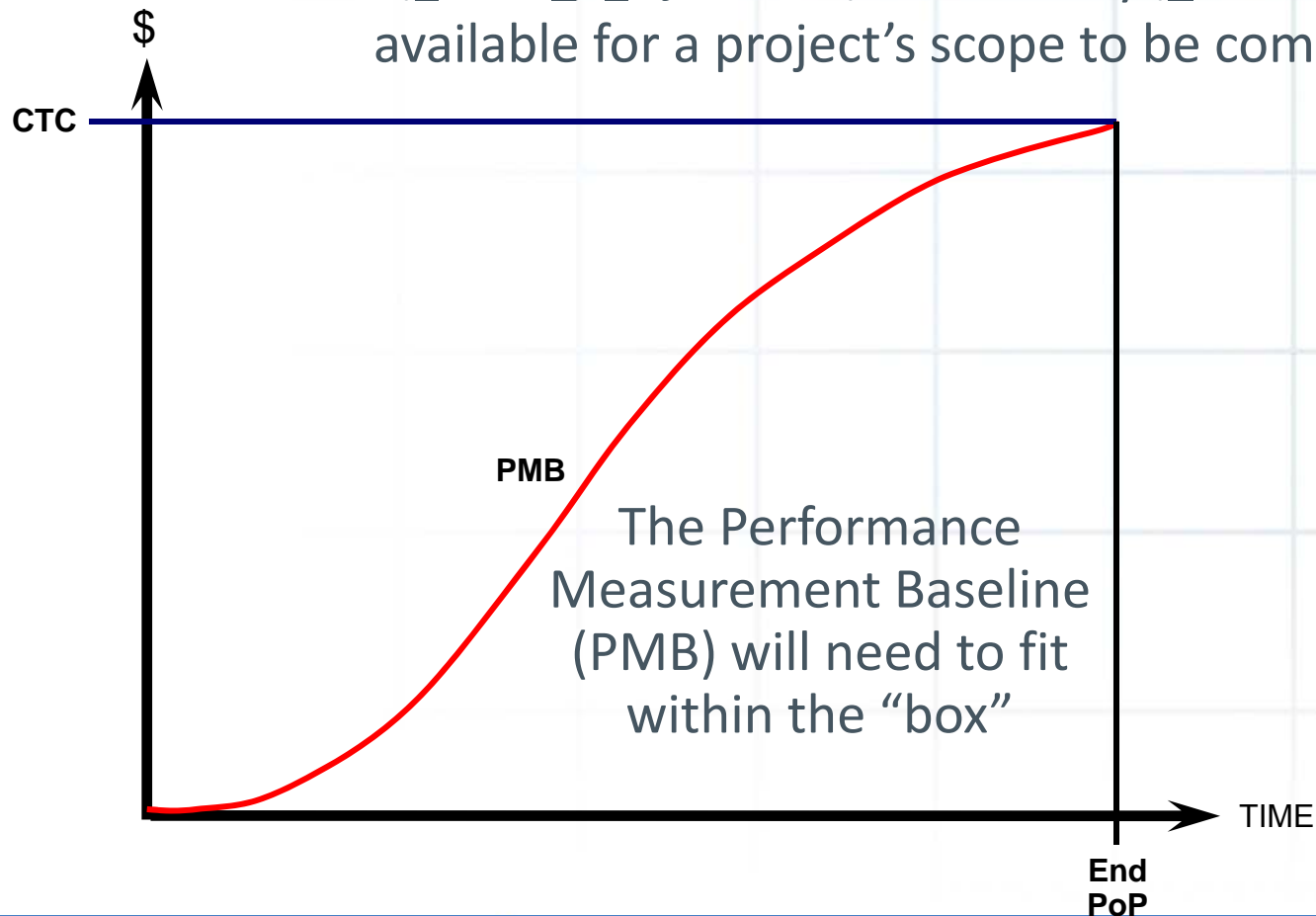
Schedule Reserve

re-serve *noun* \ri-'zərv\

- Something withheld or set aside for a particular purpose, use, or reason
- something stored or kept available for future use or need
- money or **other units kept in hand or set apart usually to meet liabilities**

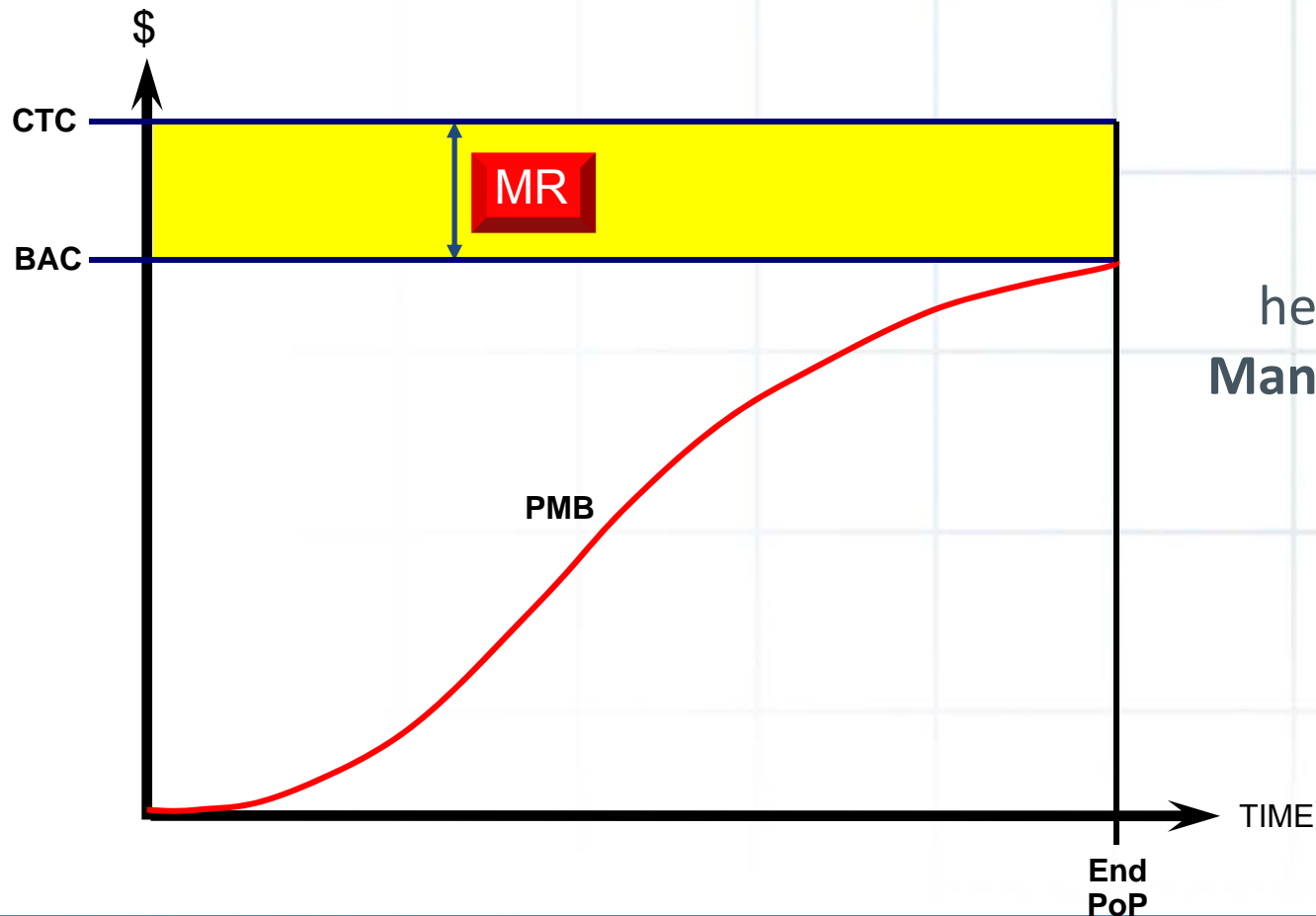
Schedule Reserve

Contractual restrictions are set for the amount of time (*Period-of-Performance*) and money (*Contract Target Cost*) available for a project's scope to be completed.



Schedule Reserve

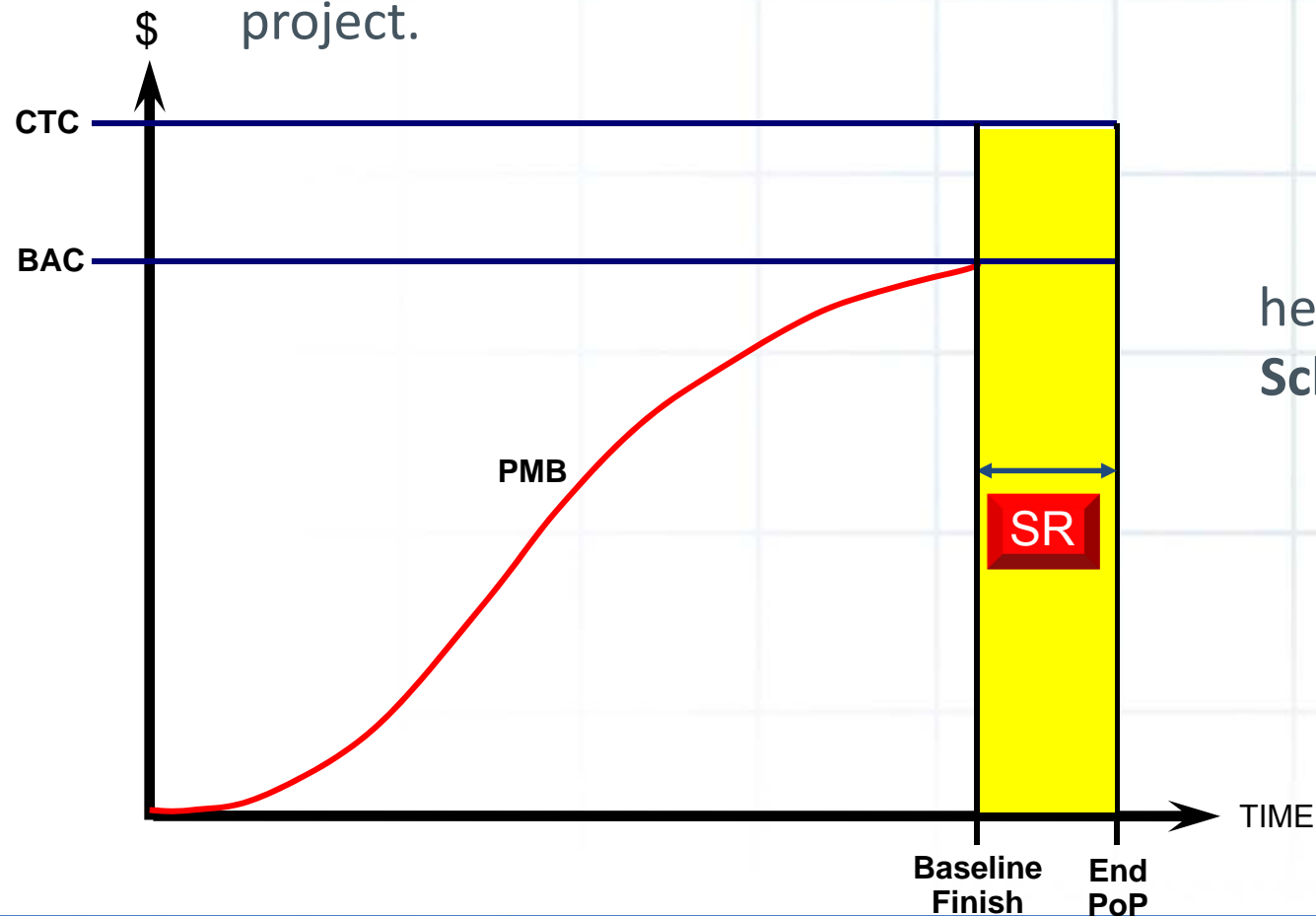
It is common practice to set an more aggressive internal cost goal by withholding some amount of budget.



The budget held back is called **Management Reserve (MR)**

Schedule Reserve

Similarly, it is sound management to set a more aggressive timeline, so that a single misstep does not result in a delinquent project.

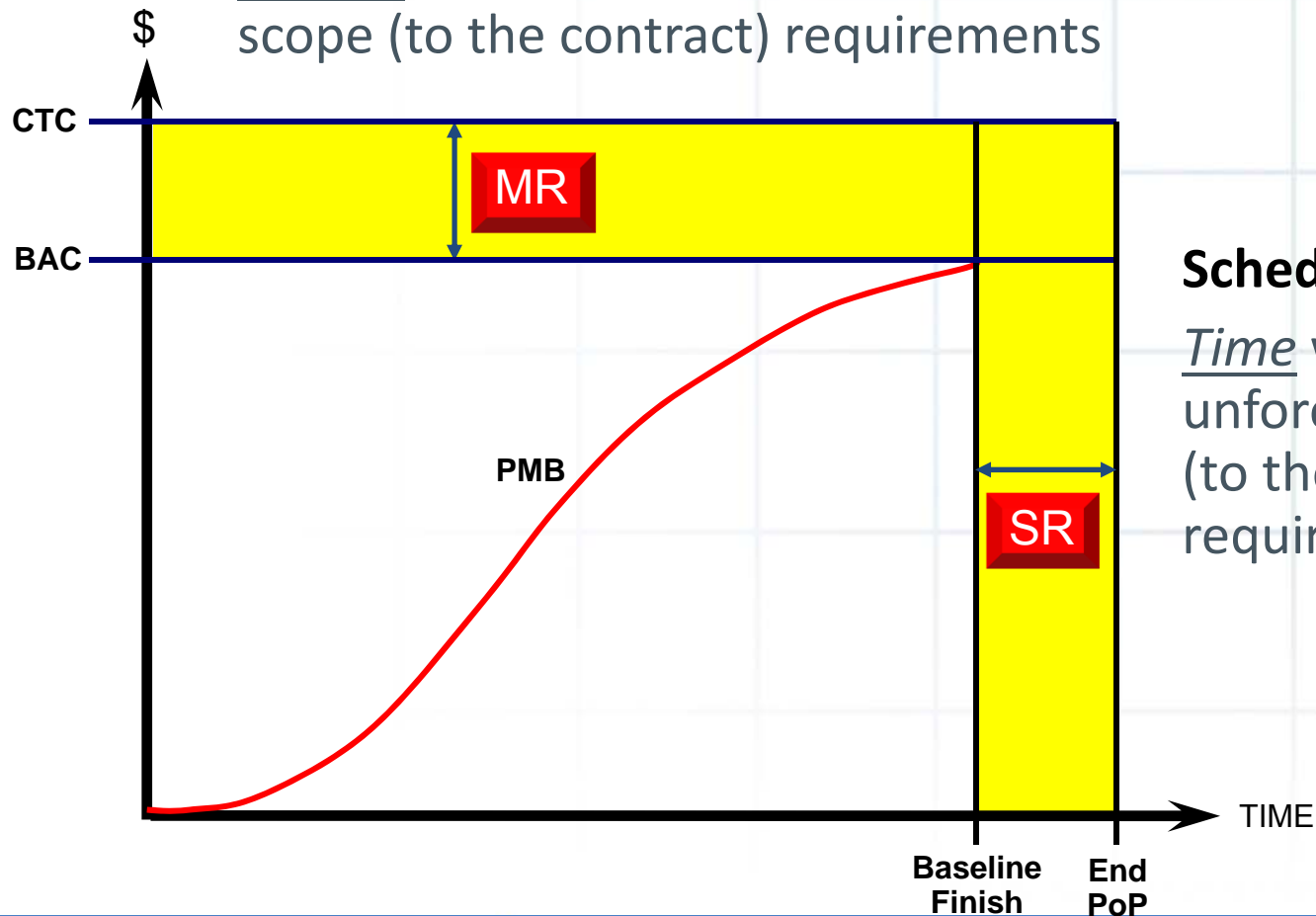


The time held back is called **Schedule Reserve (SR)**

Schedule Reserve

Management Reserve (MR)

Budget withheld for unforeseen, within-scope (to the contract) requirements



Schedule Reserve (SR)

Time withheld for unforeseen, within-scope (to the contract) requirements

Schedule Reserve

Management Reserve

- Difference between the Contract Target Cost and the Baselined Budget
- Intended to offset in-scope but unforeseen costs needs
- Not effected by the forecasted cost of the project (EAC)
- Only changed by the Program Manager via Baseline Change Request (BCR)

Schedule Reserve

- Difference between the Contractual Finish Date and the Baselined Finish Date
- Intended to offset in-scope but unforeseen time needs
- Not effected by the forecasted duration of the project
- Only changed by the Program Manager via Baseline Change Request (BCR)

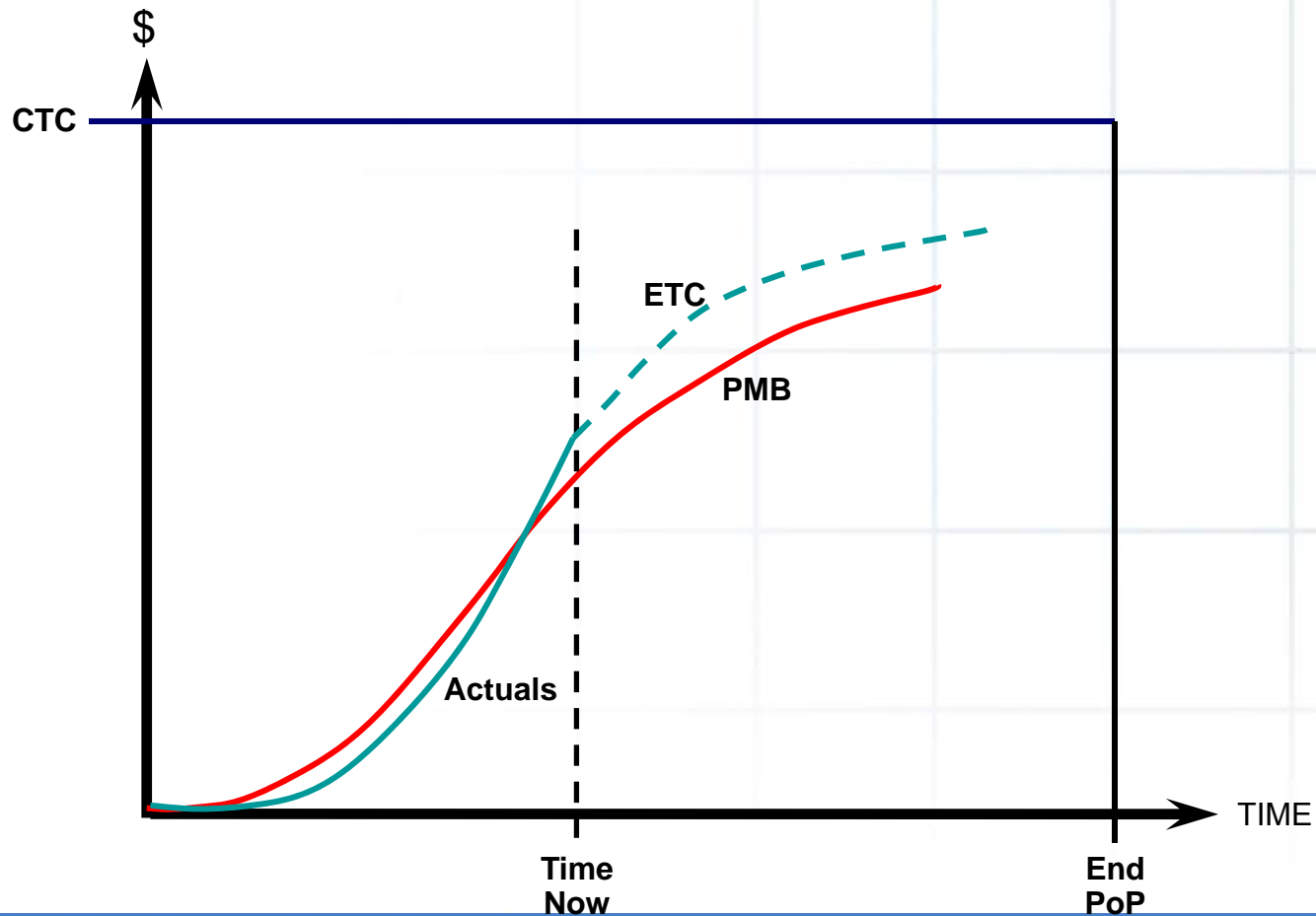
Schedule Buffer

buffer *noun* \ 'bə-fər \

- any of various devices or pieces of material for reducing shock or damage due to contact
- a means or device used as a cushion against the shock of fluctuations in business or financial activity
- something that serves as a protective barrier

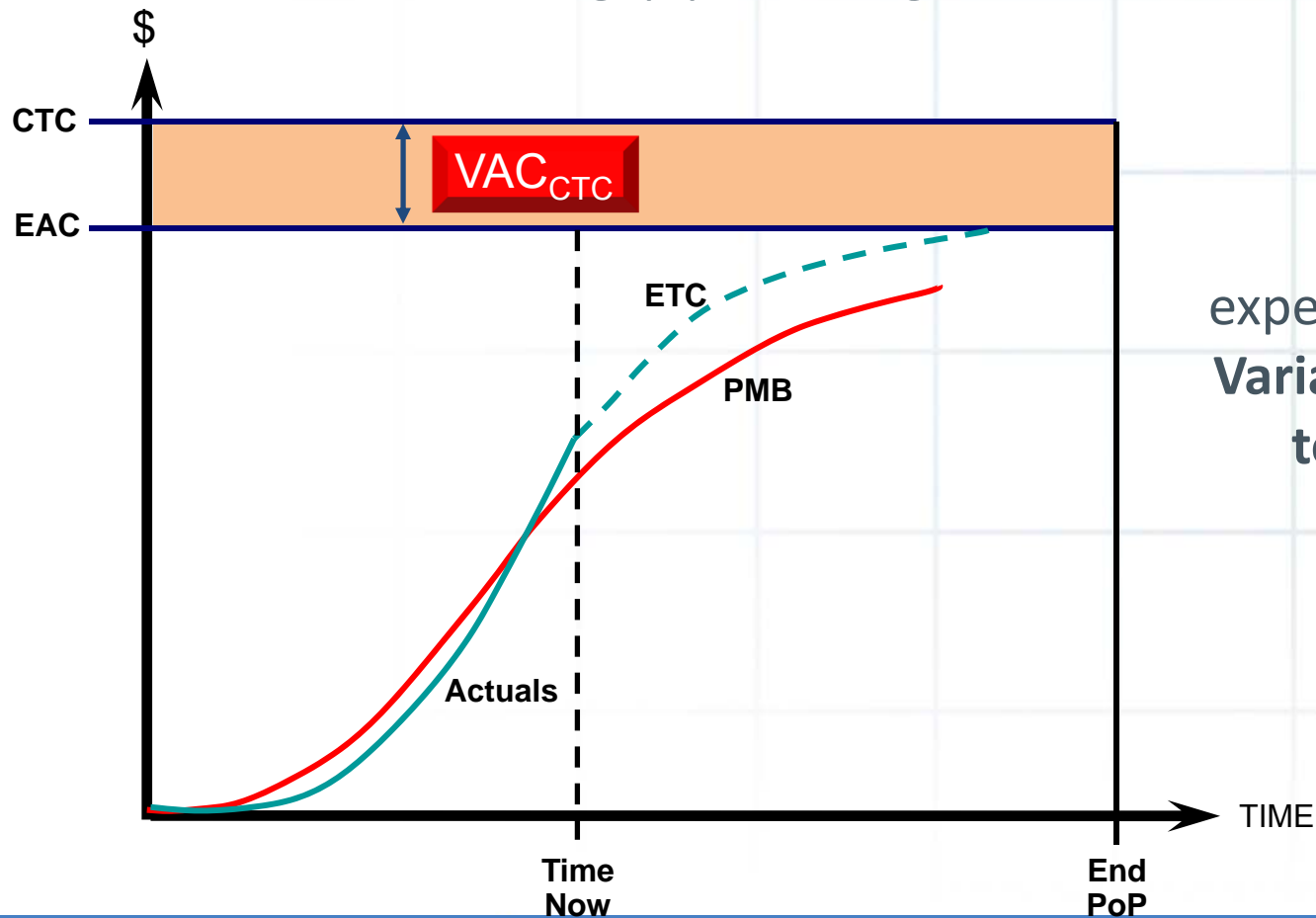
Schedule Buffer

As time progresses, deviations to the plan (both past and projected) develop.



Schedule Buffer

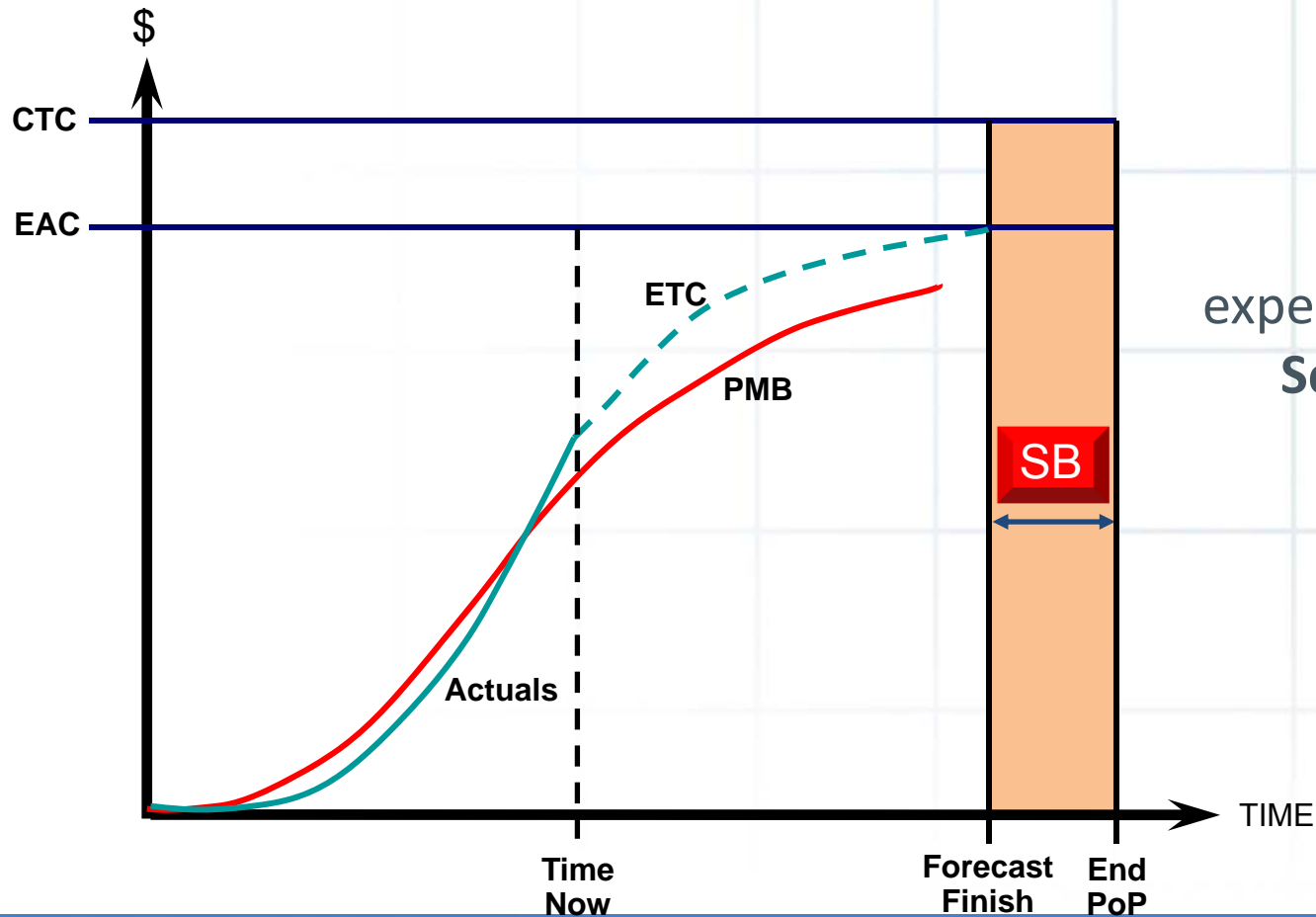
If the Estimate at Complete (EAC) rises, the amount of gap protecting the CTC diminishes.



The gap in expected cost is called **Variance at Complete to CTC (VAC_{CTC})**

Schedule Buffer

Similarly, if the forecasted completion of the project slips, the amount of gap protecting the PoP diminishes.

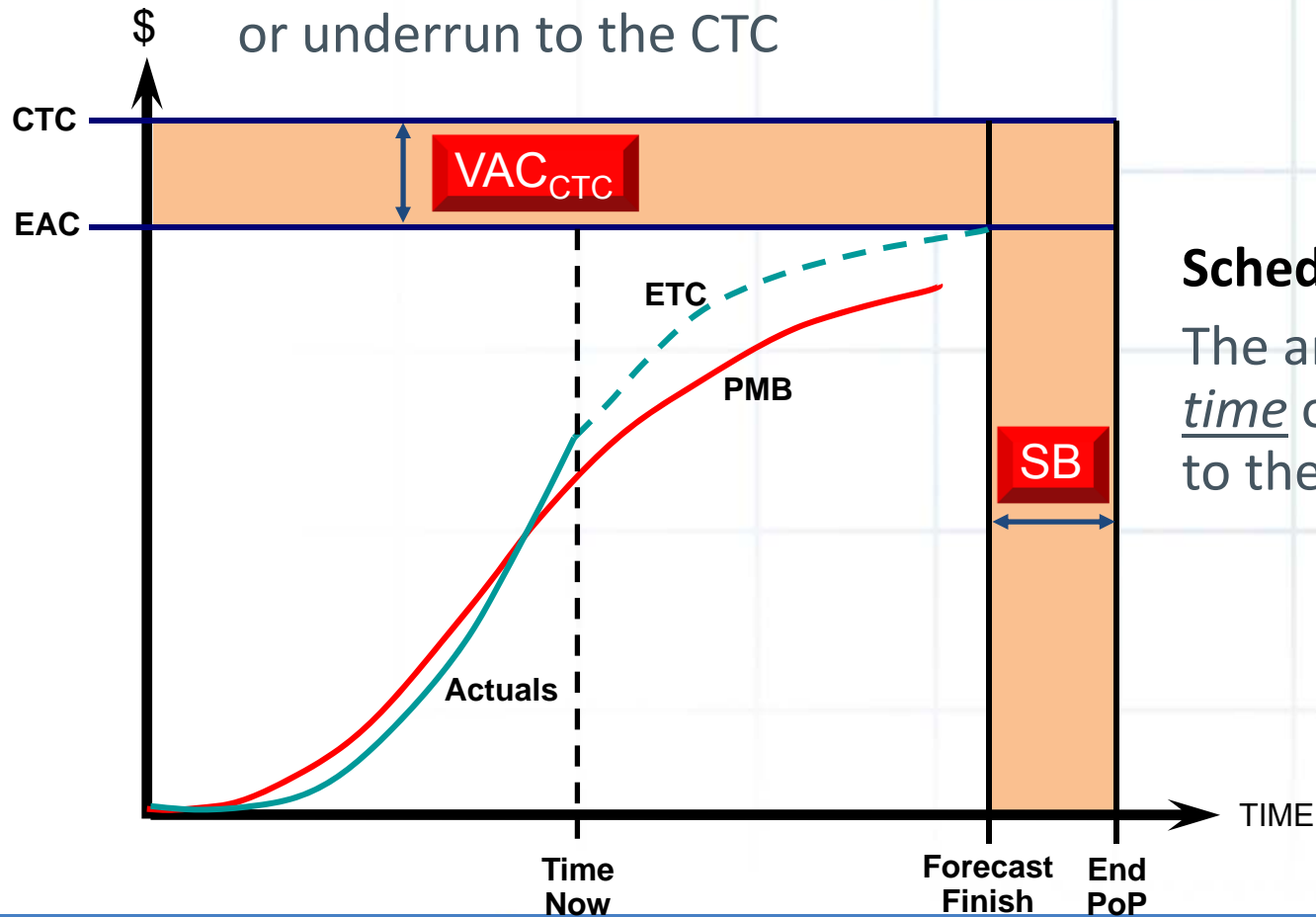


The gap in expected time is called **Schedule Buffer (SB)**

Schedule Buffer

Variance at Complete to CTC (VAC_{CTC})

The amount of expected cost overrun or underrun to the CTC



Schedule Buffer (SB)

The amount of expected time overrun or underrun to the PoP

Schedule Buffer

VAC_{CTC}

- Difference between the Contract Target Cost and the Forecasted Cost (EAC)
- Measures of the remaining contractual cost “cushion”
- Not effected by the budgeted cost of the project (BAC)
- May change every period based on actuals costs to date and estimated costs remaining (no BCR required)

Schedule Buffer

- Difference between the Contractual Finish Date and the Forecasted Finish Date
- Measures of the remaining contractual time “cushion”
- Not effected by the baselined duration of the project
- May change every period based on actuals progress to date and estimated time remaining (no BCR required)

Schedule Margin/Contingency

mar·gin *noun* \ 'mär-jən \

- a spare amount or measure or degree allowed or given for contingencies or special situations

time held
by the contractor

con·tin·gen·cy *noun* \kən-'tin-jən(t)-sē\

- an event (as an emergency) that may but is not certain to occur
- something liable to happen as an adjunct to or result of something else

time held at or above
the government PMO
(or owner, for commercial projects)

Margin and Contingency are similar in form and function,
but controlled by different owners

Schedule Margin

Risk, Uncertainty and Michael Jordan

- In 1996 at the height of the Jordan-era, it is possible that the Chicago Bulls were favored to win all 82 of their games
- Using the most likely outcome for each game, you would predict that the Bulls would total ZERO losses for the season
- In reality, over the course of a season even Jordan will have off nights (uncertainty) and the team is likely to suffer key injuries (risks), resulting in unexpected losses
- A shrewd gambler would take these risks and uncertainties into consideration before placing a bet on the Bull's season win totals
- Because of these risks and uncertainties, it is highly unlikely that the Bulls would go 82-0 (and they didn't)

Schedule Margin

Game 1 WIN! + Game 2 WIN! + Game 3 WIN! + ... + Game 82 WIN! \neq **82 WINS**

The sum of the “most likely” individual game results,

does not necessarily equal the “most likely” season win total

Schedule Margin

Program Manager's EAC

- Likewise, a PM should not simply sum the most likely EACs for every task (or WP, or CA) and assume that is the most likely EAC for the entire project
- Cost estimates for risks (and opportunities) and uncertainties should be factored in to improve the accuracy and add realism to a project's reported EAC

For lack of a more standard term, we will refer to the difference between the “CAM generated” EAC and the PM's “most likely” EAC as the **Management Contingency**

Schedule Margin

$$\begin{array}{ccccccc} \text{CA} & & \text{CA} & & \text{CA} & & \text{CA} \\ 1 & + & 2 & + & 3 & + \dots & 10 \\ \$1\text{M} & & \$1\text{M} & & \$1\text{M} & & \$1\text{M} \\ & & & & & & \neq & \$10\text{M} \end{array}$$

The sum of the “most likely” individual Control Account EACs,

does not necessarily equal the “most likely” program EAC

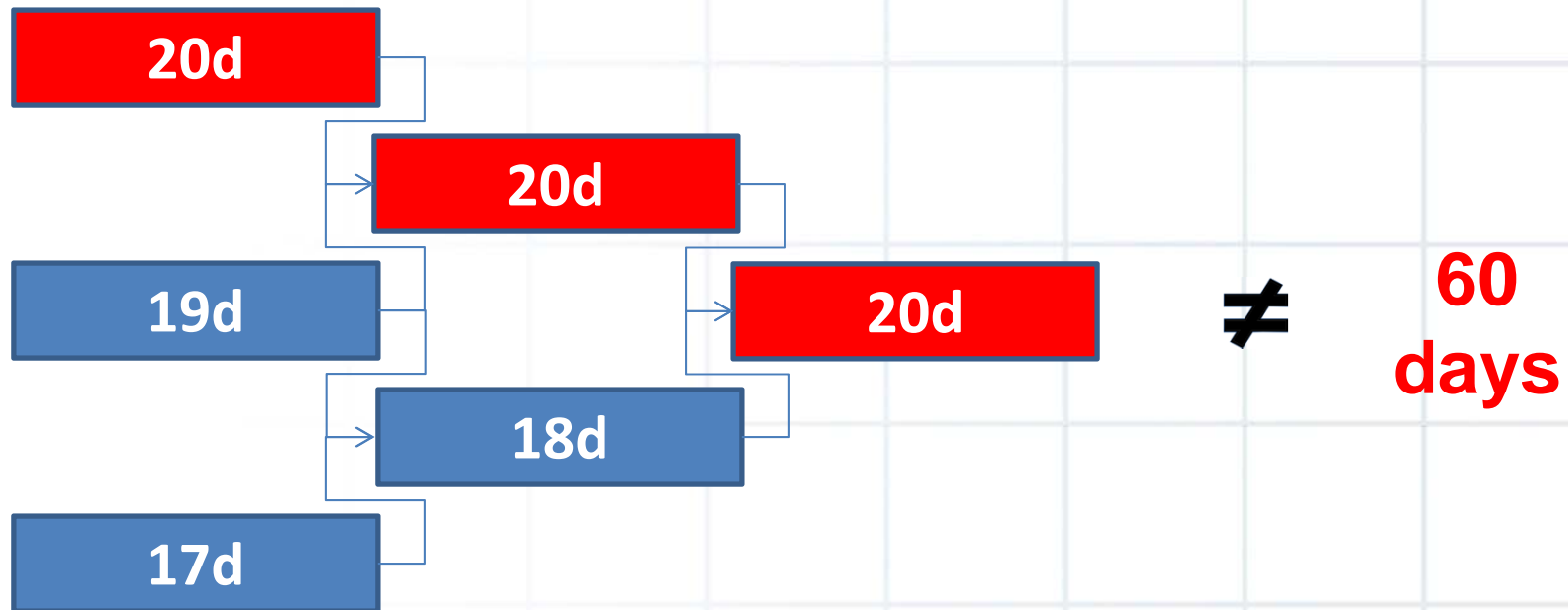
Schedule Margin

Program Manager's ECD

- Similarly, summing up the most likely durations for each activity along the critical path, is generally not the most reliable estimate of project completion
- Without making consideration for risks and uncertainties, the deterministic completion forecast in an IMS may have a very low (sometimes approaching zero) percent chance of occurrence

The difference between the “CAM generated” completion forecast (from the IMS) and the PM’s “most likely” ECD is the **Schedule Margin**

Schedule Margin



The sum of the “most likely” individual task durations,

does not necessarily equal the “most likely” program duration

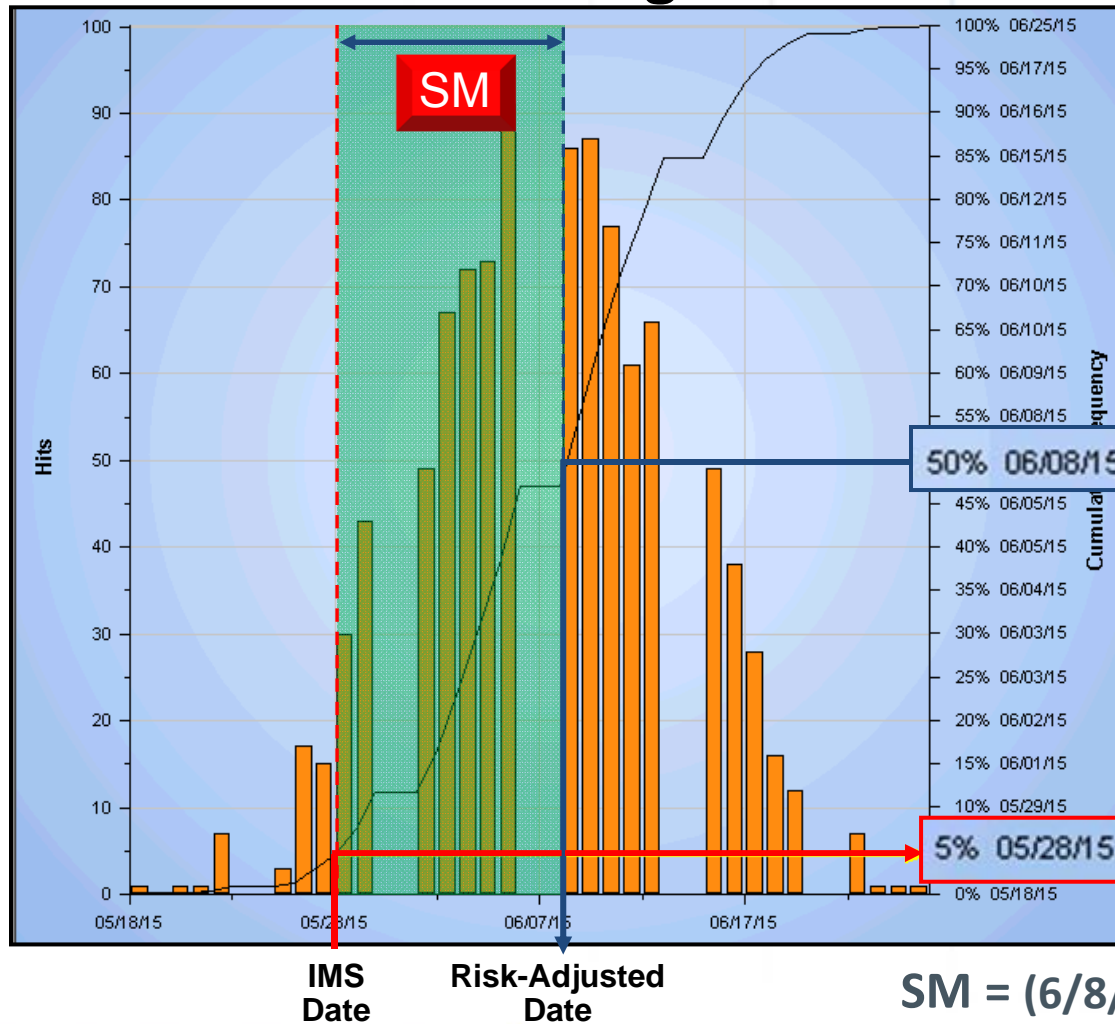
Schedule Margin

Calculating Schedule Margin

- There are various ways (depending on the tools and information available) to quantify the durations associated with risks and uncertainty
 - Ideally, a Schedule Risk Assessment (SRA) can be performed
 - SRAs perform 100's (or 1000's) of simulations of possible schedule results using various combinations of task uncertainties and risk event outcomes
 - Results in a range of estimated completion dates for a project
 - If an SRA cannot be utilized, more “manual” risk assessment methods will need to be incorporated

Schedule Margin

SRA Histogram



The difference between an unacceptably unlikely forecast from the IMS...

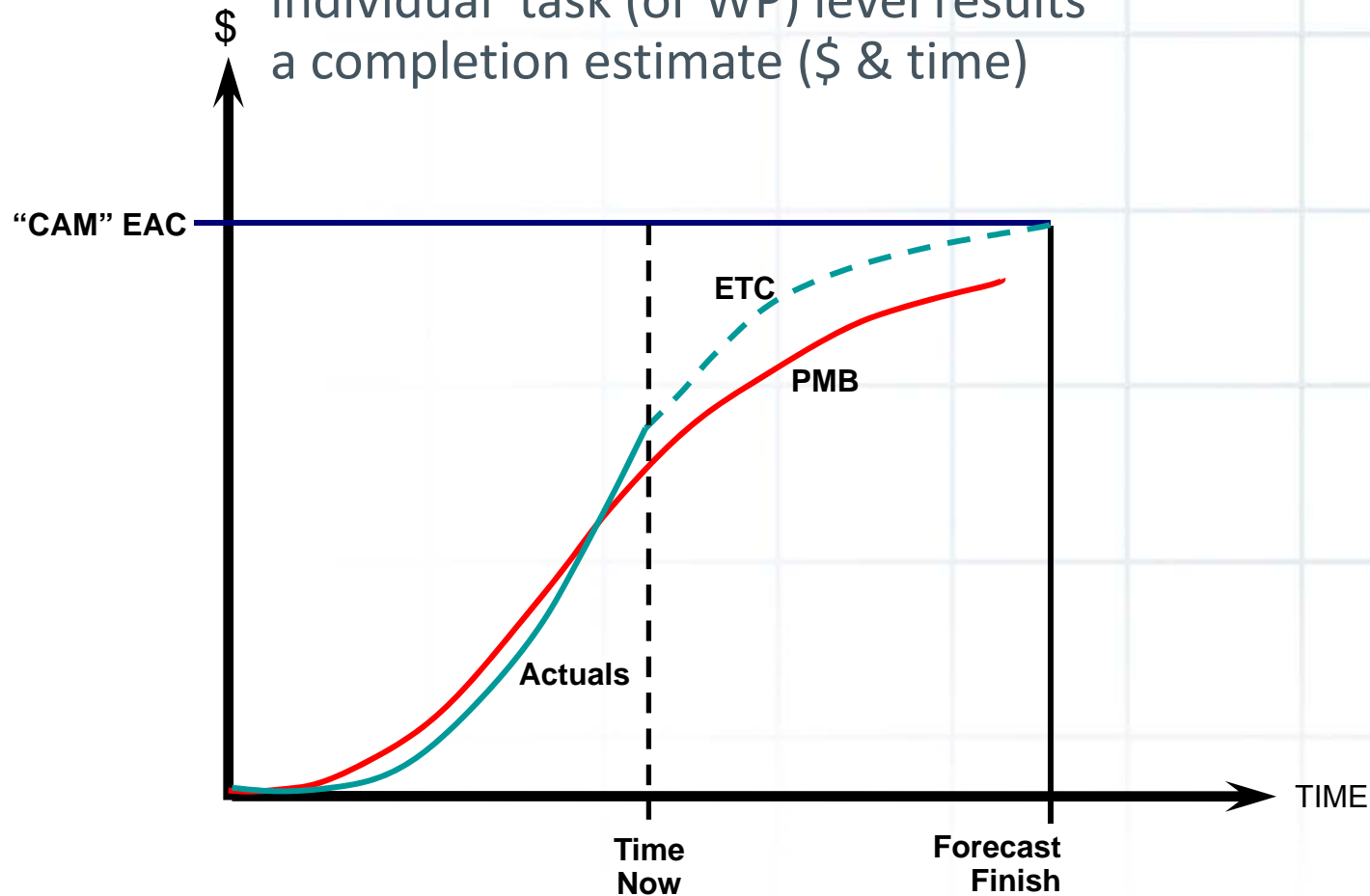
and the acceptably likely risk-adjusted date...

yields the amount of Schedule Margin (SM) needed to be included in the IMS in order to provide a more reliable completion date

$$SM = (6/8/15) - (5/28/15) = 7 \text{ working days}$$

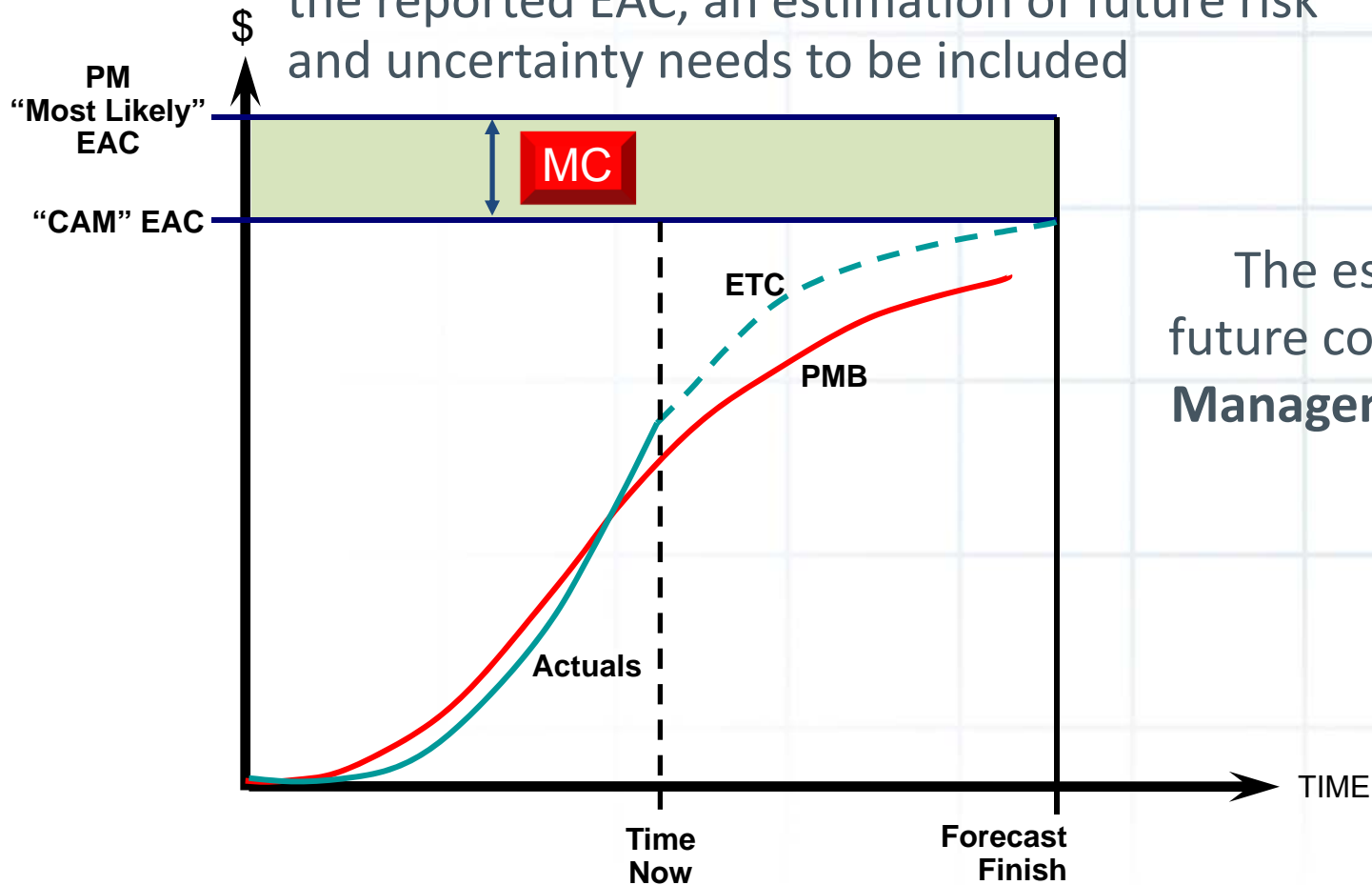
Schedule Margin

The accumulation of status at the individual task (or WP) level results a completion estimate (\$ & time)



Schedule Margin

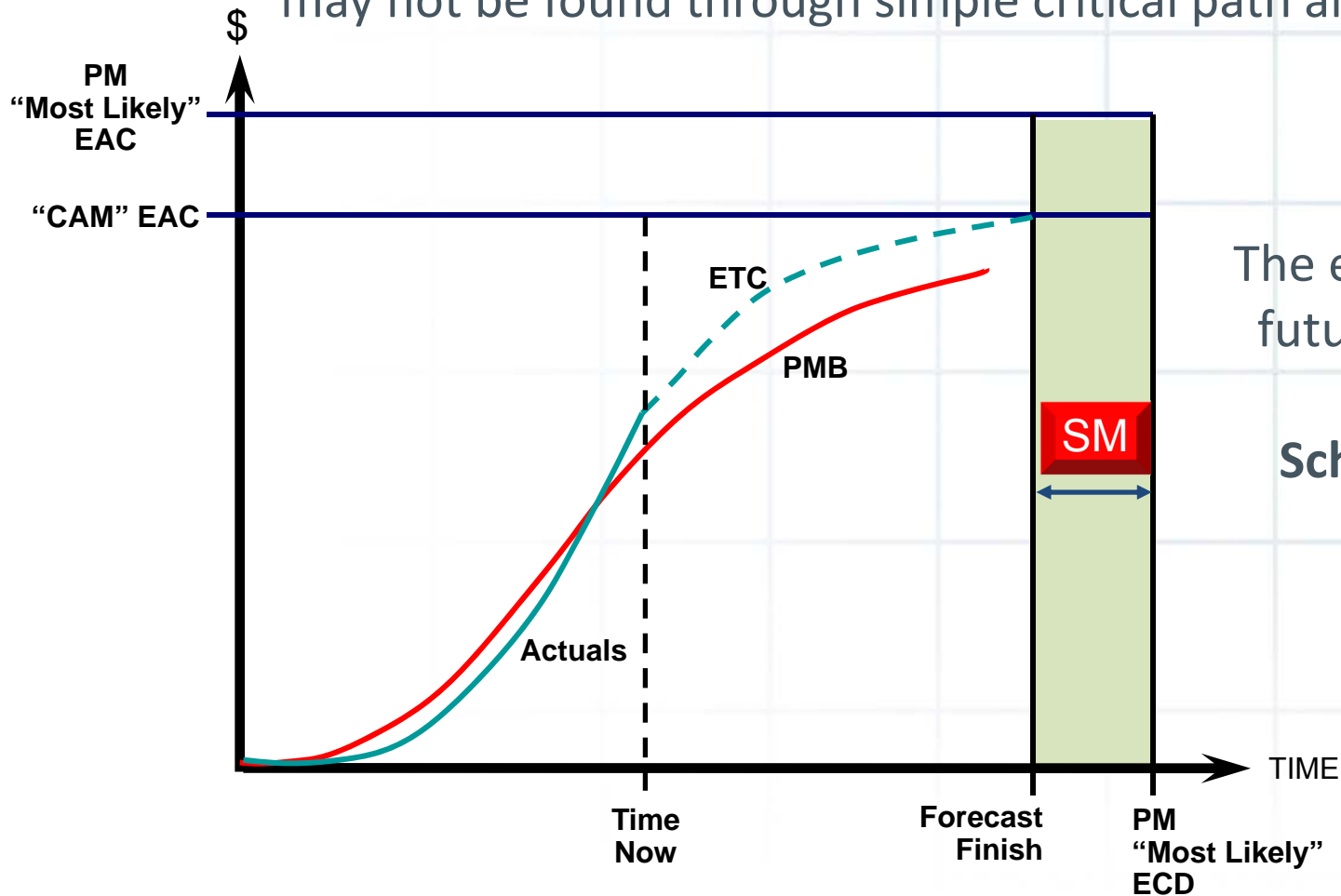
In order for a PM to maximize the accuracy of the reported EAC, an estimation of future risk and uncertainty needs to be included



The estimate of likely future cost growth is called **Management Contingency (MC)**

Schedule Margin

Similarly, the most accurate estimate of project completion may not be found through simple critical path analysis.

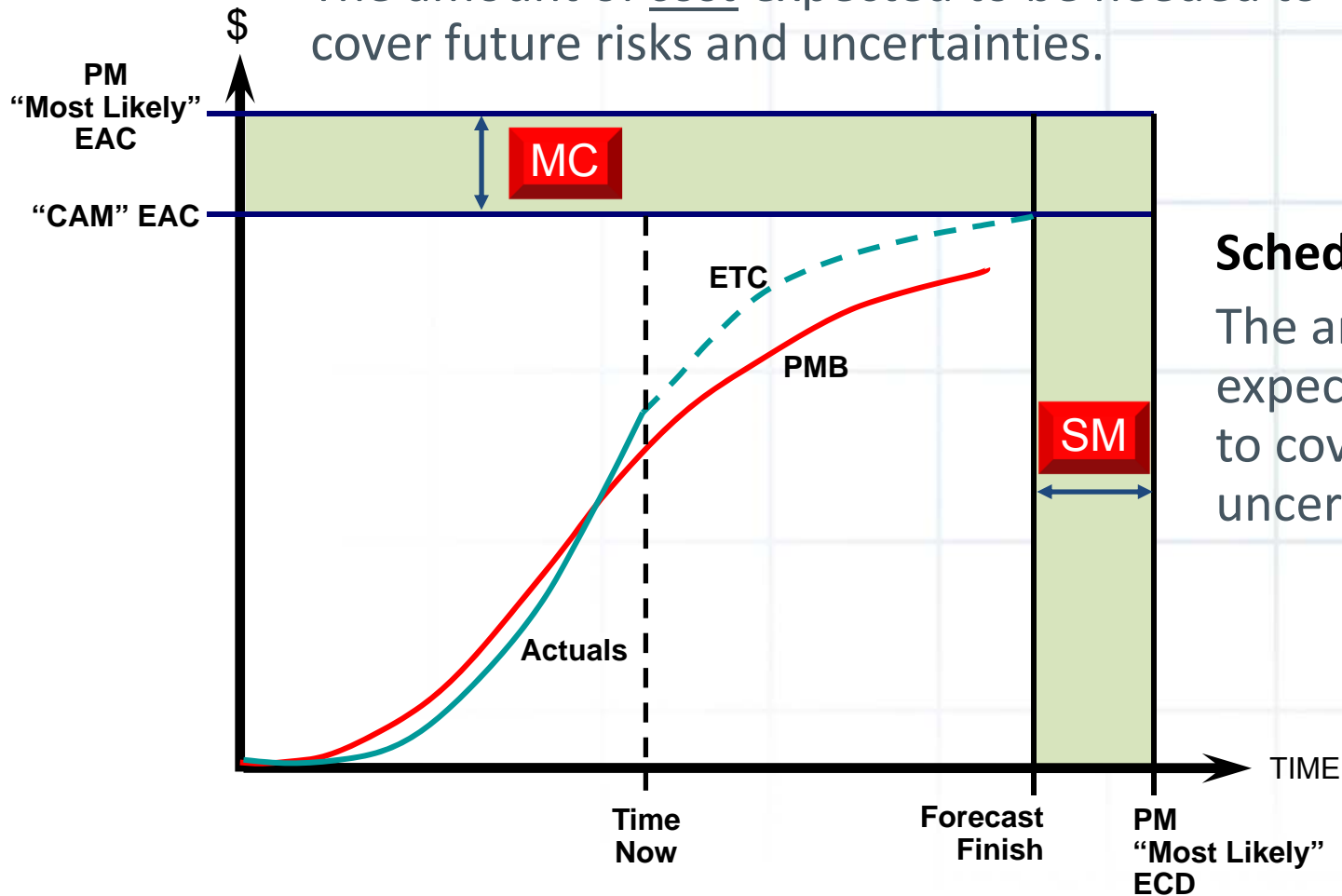


The estimate of likely future time growth is called **Schedule Margin (SM)**

Schedule Margin

Management Contingency (MC)

The amount of cost expected to be needed to cover future risks and uncertainties.



Schedule Margin (SM)

The amount of time expected to be needed to cover future risks and uncertainties.

Schedule Margin

Cost Contingency

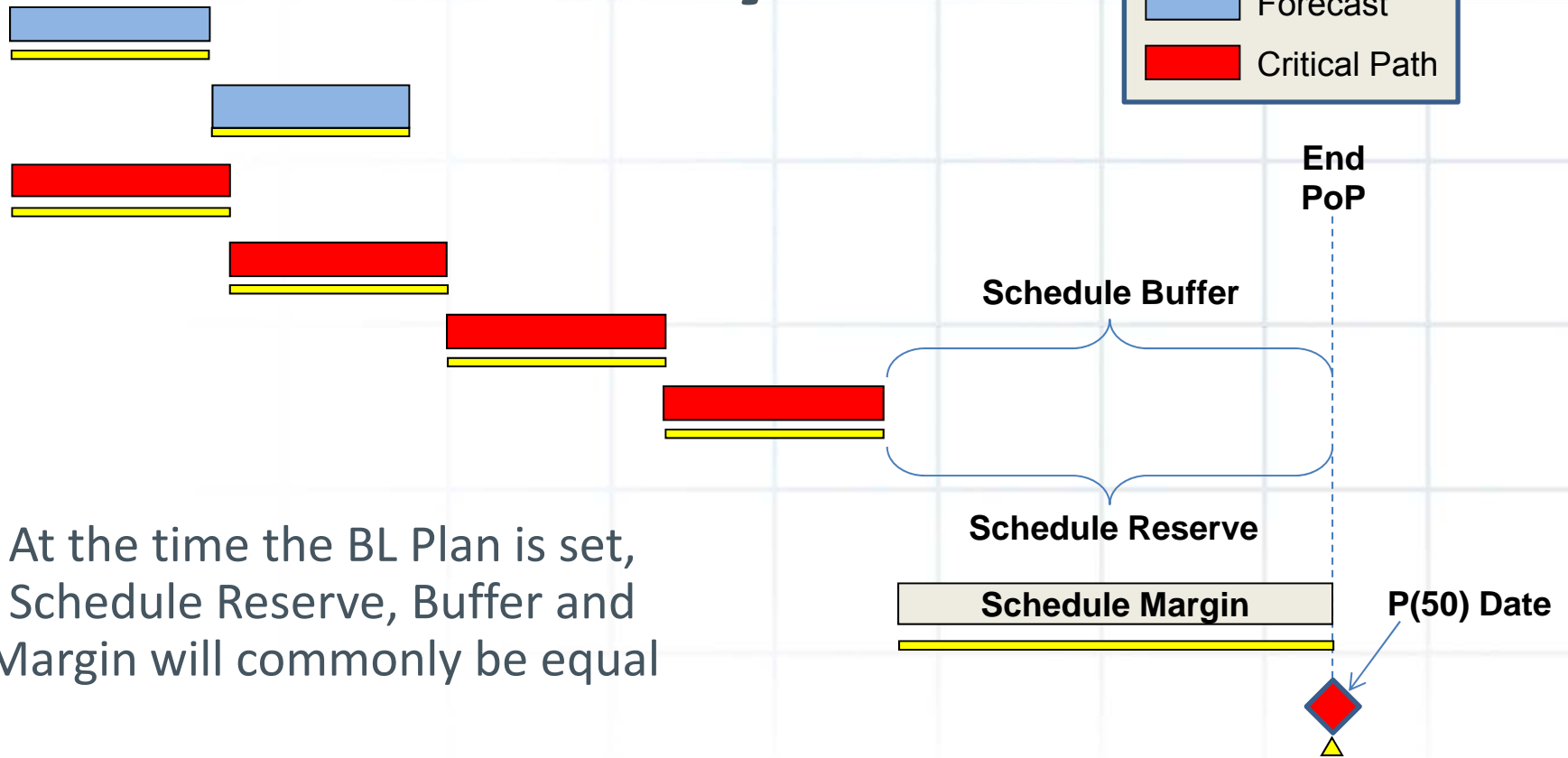
- Difference between PM's "Most Likely" EAC and the "CAM generated" EAC
- Measures of the remaining risk/opportunities and uncertainty to the final cost of a project
- Not effected by the budgeted cost of the project (BAC)
- May change every period based on the mitigation of risks, capture of opportunities, and reduction of uncertainties

Schedule Margin

- Difference between PM's "Most Likely" ECD and the "IMS generated" completion forecast
- Measures of the remaining risk/opportunities and uncertainty to the ultimate completion date of a project
- Not effected by the baseline completion date of the project
- May change every period based on the mitigation of risks, capture of opportunities, and reduction of uncertainties

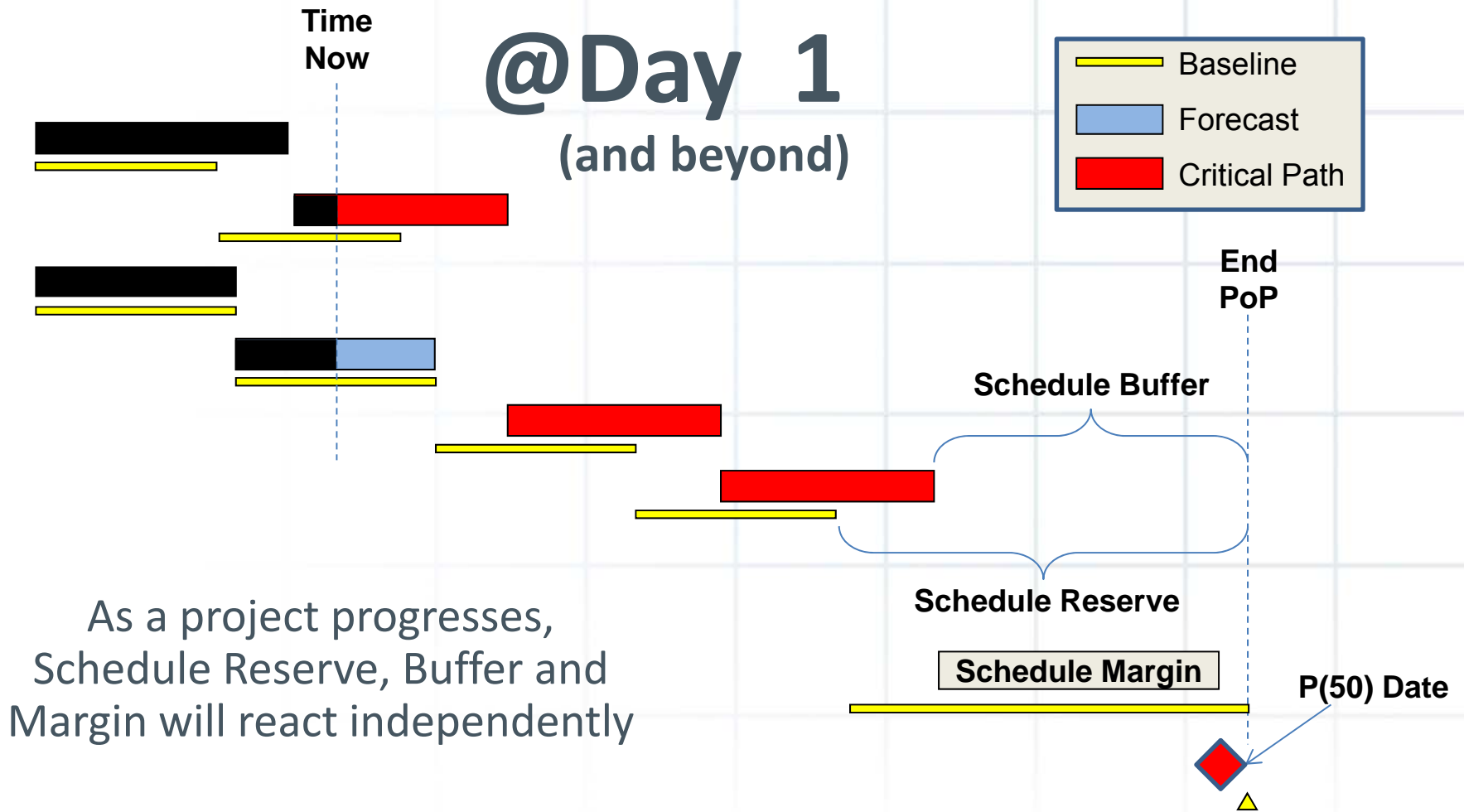
Schedule Reserve vs Buffer vs Margin

@Day 0

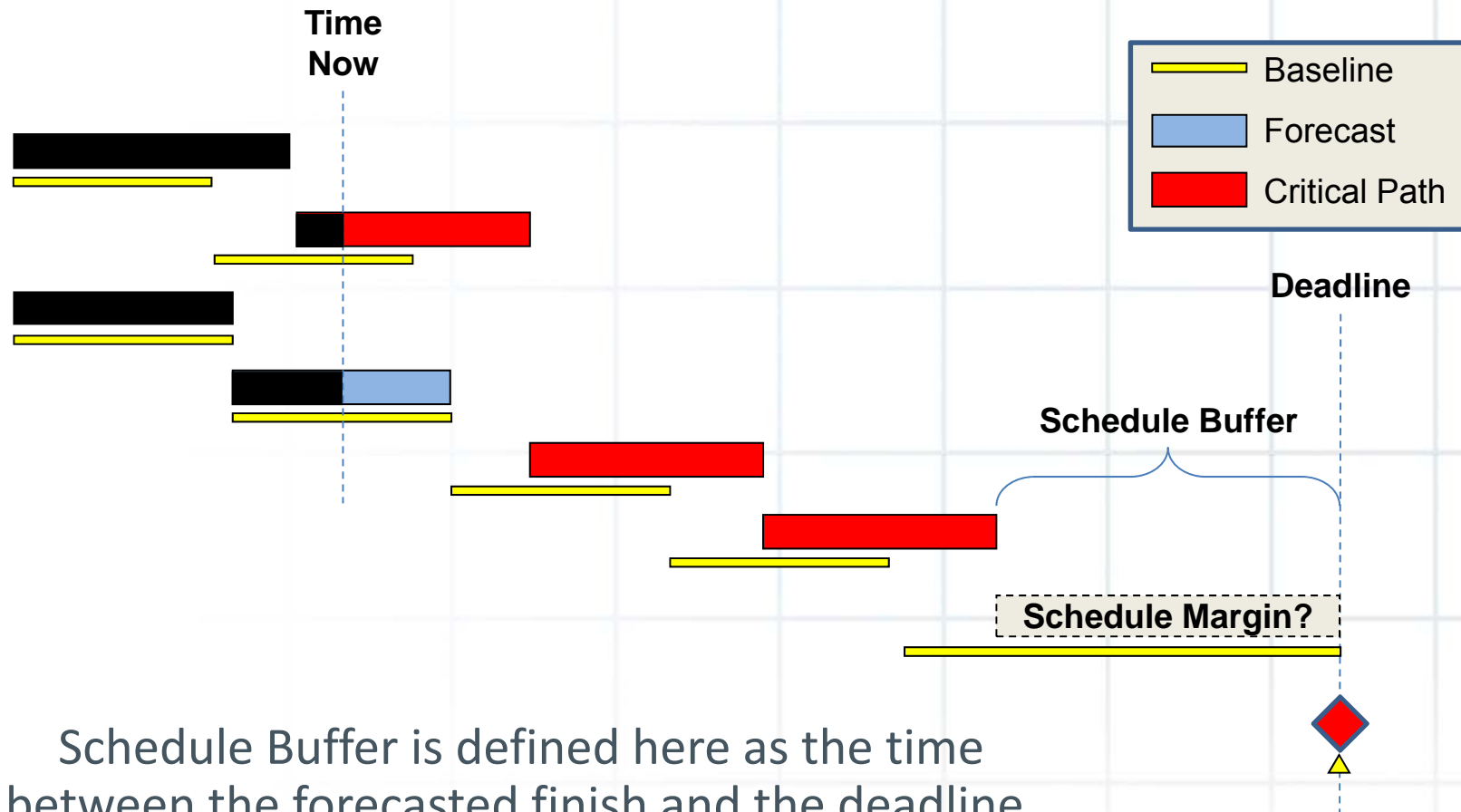


At the time the BL Plan is set, Schedule Reserve, Buffer and Margin will commonly be equal

Schedule Reserve vs Buffer vs Margin



Why not make Buffer the SM Task?

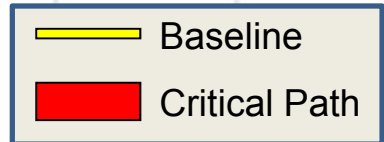


Schedule Buffer is defined here as the time between the forecasted finish and the deadline.

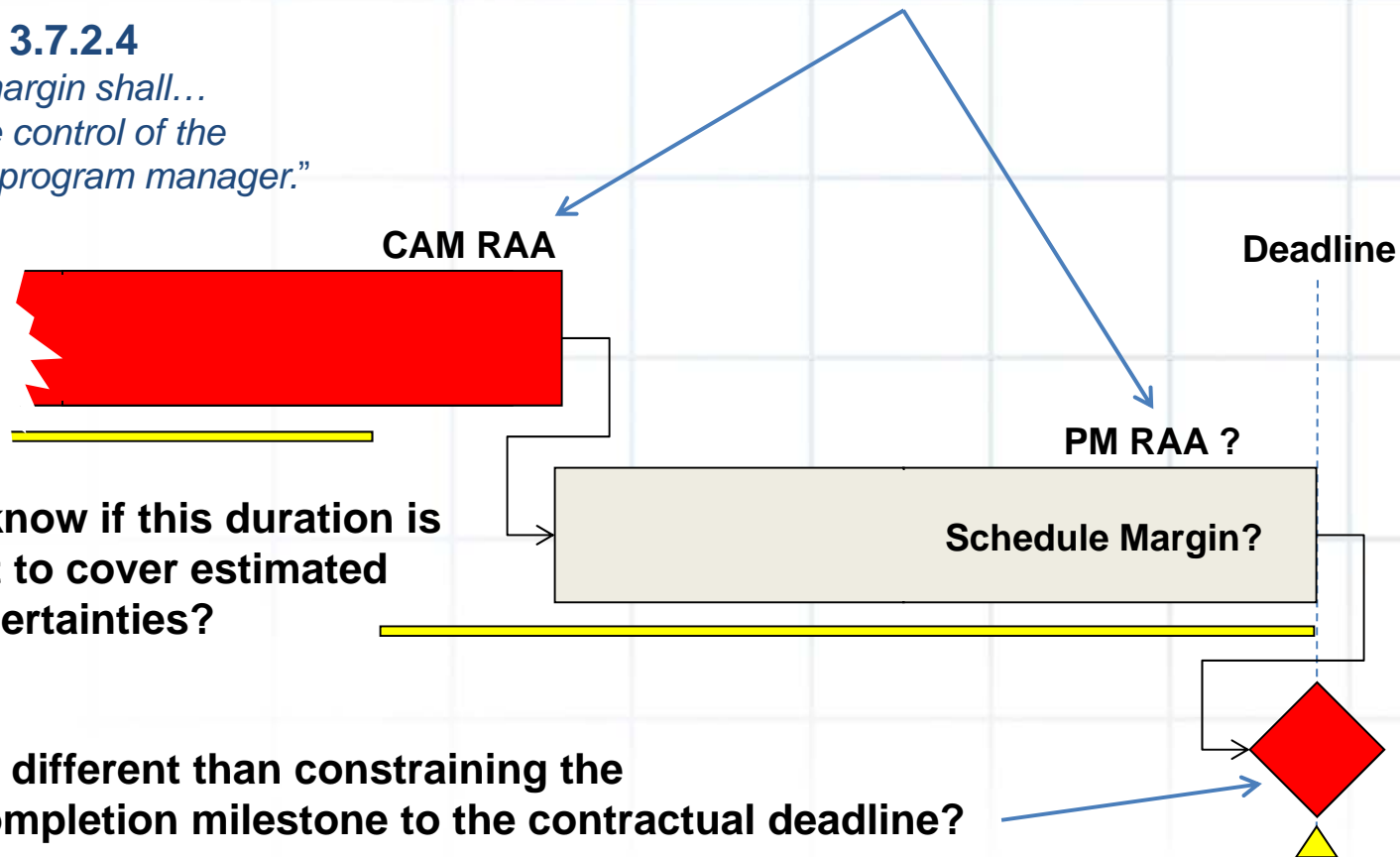
Why isn't this Schedule Margin?

Why not make Buffer the SM Task?

- ❖ Does the PM really own this Schedule Margin duration... or do the CAMs along the critical path determine this SM length?



- IPMR DID 3.7.2.4
"Schedule margin shall... be under the control of the contractor's program manager."

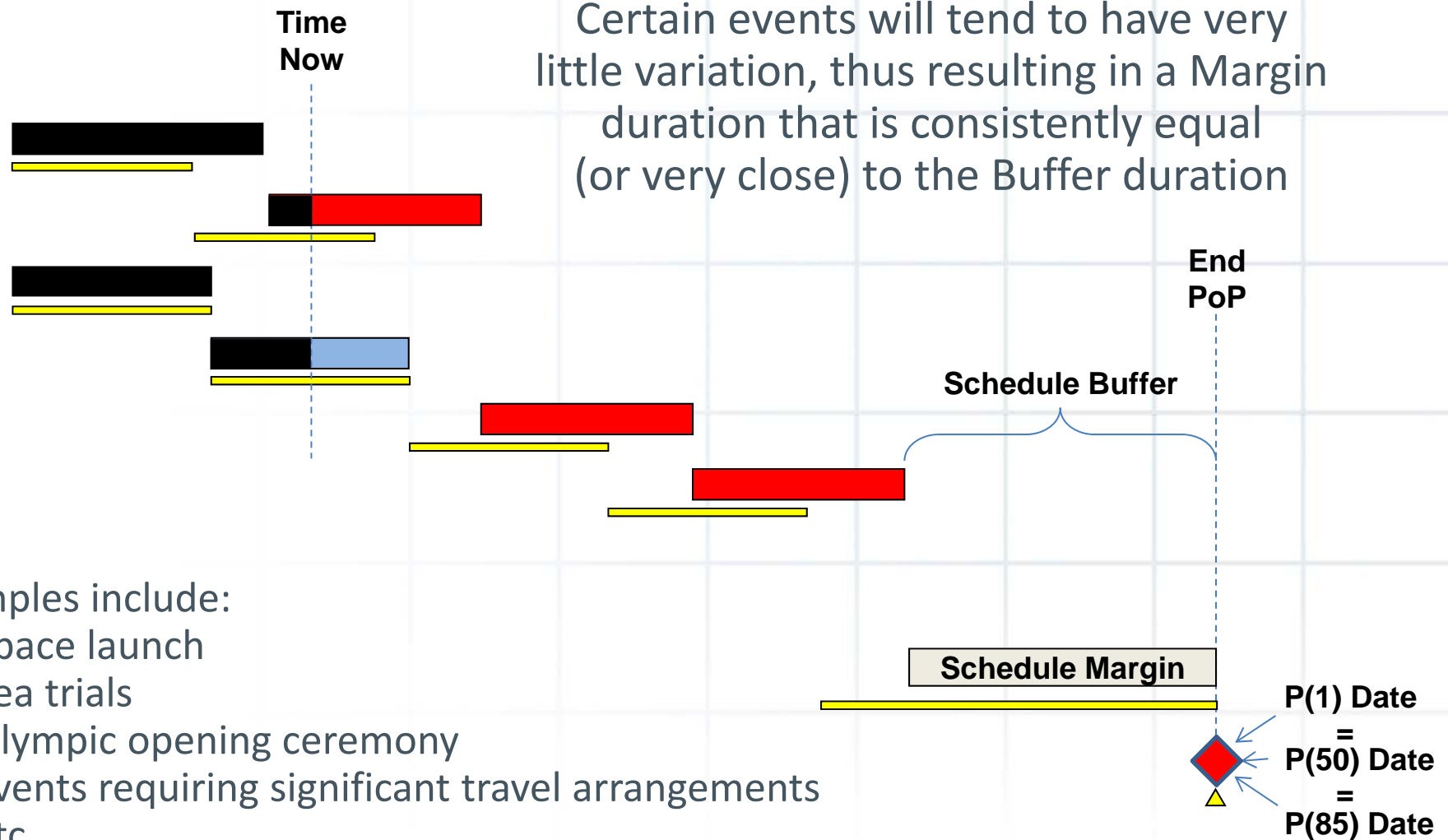


- ❖ How do you know if this duration is still sufficient to cover estimated risks and uncertainties?

- ❖ Is this all that different than constraining the forecasted completion milestone to the contractual deadline?

- Is the goal to maximize the forecast accuracy, or hold a completion target?

Margin may equal Buffer



Examples include:

- Space launch
- Sea trials
- Olympic opening ceremony
- Events requiring significant travel arrangements
- etc

Reserve vs Buffer vs Margin

	Schedule Reserve	Schedule Buffer	Schedule Margin (Schedule Contingency)
Definition	The amount of time between the baselined completion of a significant event* and its associated required completion date.	The amount of time between the forecasted completion of a significant event* and its associated required completion date.	A program manager's assessment of the amount of additional duration risk/uncertainty associated with a significant event* (generally derived from an SRA)
Formula	SR = End PoP - BL Finish	SB = End PoP - Forecast Finish	SM = P(?) - Forecast Finish
Cost counterpart	Management Reserve (MR)	Variance at Complete to CTC (VAC_{CTC})	Management Contingency
Represented with a task in the IMS?	No	No	Yes (forecast and baseline)
Can it be a negative value?	Yes (but only in an OTS situation)	Yes (if forecasted late to deadline)	No (will trend toward zero)
Stability	Stable (only changed via BCR)	Semi-Fluid (start is driven by the IMS forecast, but end is bounded by the PoP)	Fluid (start is driven by the IMS forecast, and end moves with the amount of risk/uncertainty remaining)
Rapid decrease in duration	Unfavorable	Unfavorable	Favorable (generally)

* "Significant Events" include major logical integration points, such as contract events, major test and integration milestones, or end item deliverables.

What if...



what *if*...

terms like Schedule Margin, Reserve and Buffer had clear and unique definitions?



what *if*...

their durations were not subjective, but instead were precisely calculated ?



what *if*...

they were consistent with their more well established “cost” counterparts?



what *if*...

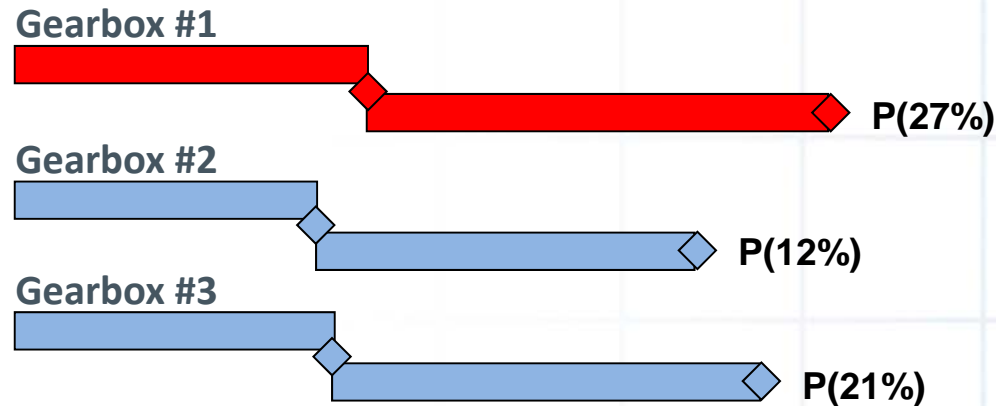
these definitions and formulas were standard across all of government and industry?

Questions???

Additional Topics (in back-up slides)

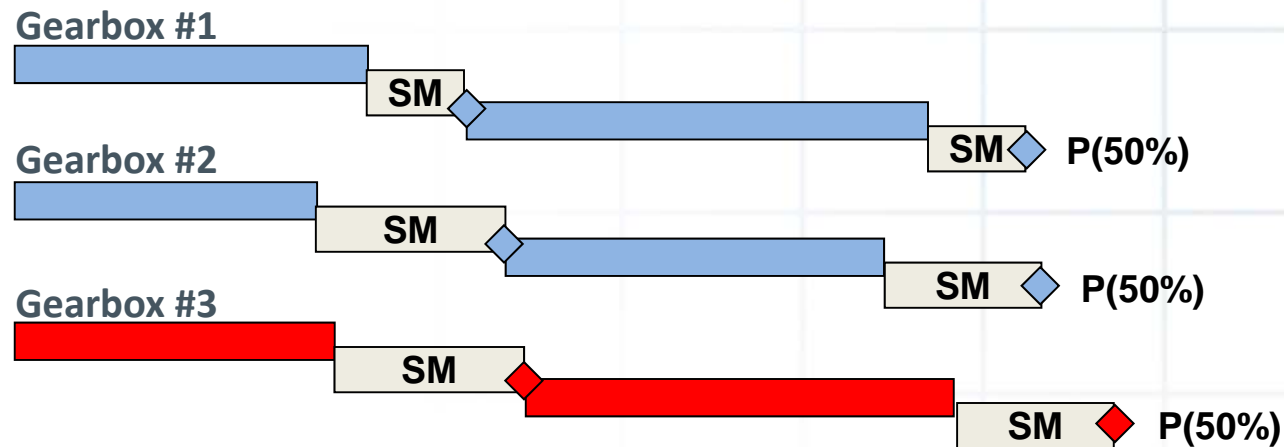
- Should SM be allowed to fall on the critical path?
- What is the effect of SM with discrete successors on metrics and manpower?
- Should SM tasks be removed/dissolved prior to entering the EV freeze period?
- Why is a rapid decrease in SM duration good?
- Common contradictory perceptions of SM

Should SM be on the CP?



The deterministic CP runs through Gearbox #1...
...however, none of the forecasted deliveries carry a high confidence level.

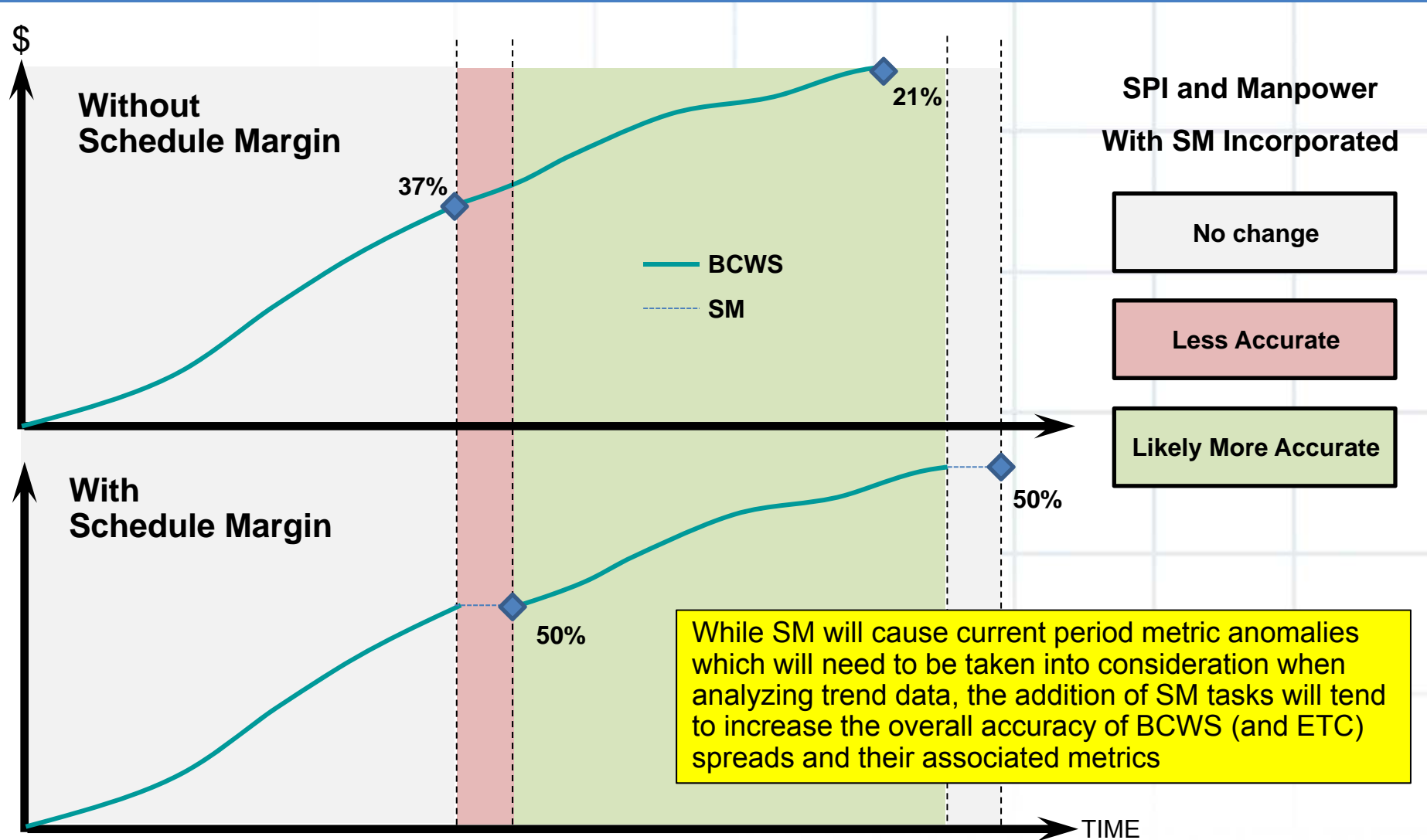
CP w/o SM
CP with SM



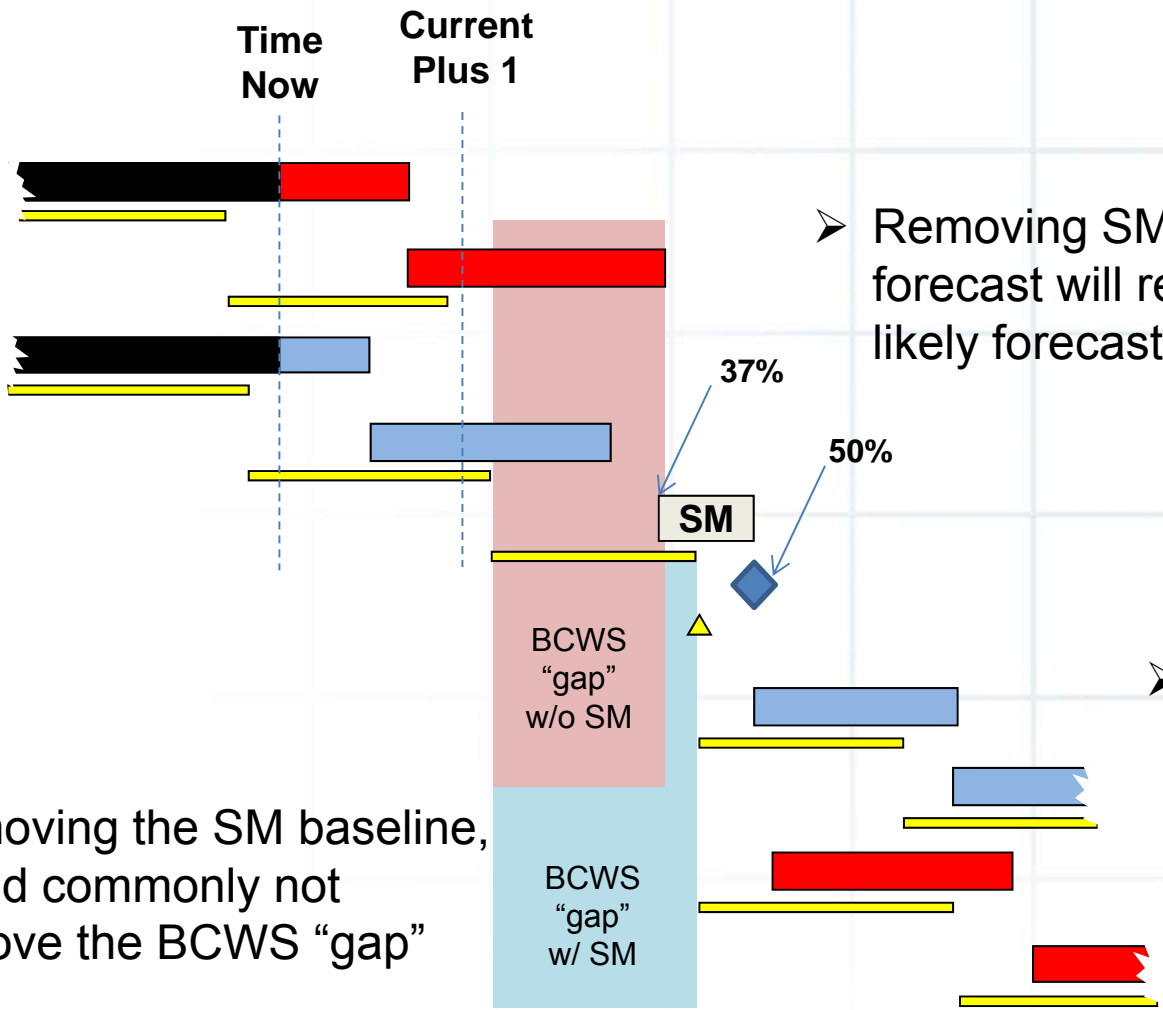
When risk/uncertainty is factored in, it is more likely that Gearbox #3 will ultimately take longer to complete.

While both scenarios should be evaluated, it is generally more valuable to concentrate effort on what the CP is likely to be vs an unlikely current depiction of the CP.

Effect of SM (with discrete successors) on Metrics



Should SM be removed (prior to the freeze period)?



➤ Removing SM from the forecast will result in a less likely forecast for the event

➤ Removing the SM baseline, would commonly not remove the BCWS “gap”

➤ A BCR(s) to adjust all downstream effort could touch many, many Control Accounts stretching years into the future

Removal of SM from an IMS can require significant effort with minimal (or even detrimental) benefit

Why is a rapid SM decrease good?

COST

“...investors try to increase the expected return on their portfolios and to reduce the standard deviation of that return.”

Principles of Corporate Finance (Brealey, Myers and Allen)

SCHEDULE

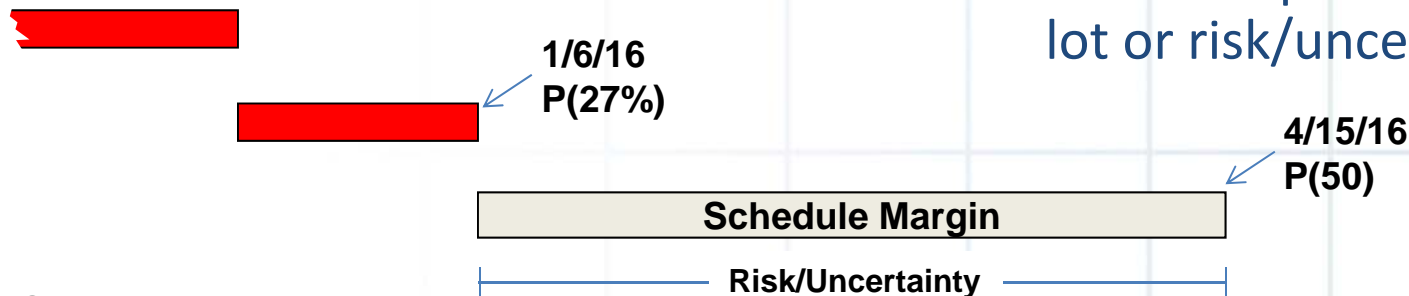
“...Program Managers try to decrease the expected duration of their projects and to reduce the risk/uncertainty of that duration.”

Principles of Awe-inspiring Scheduling (Qualls)

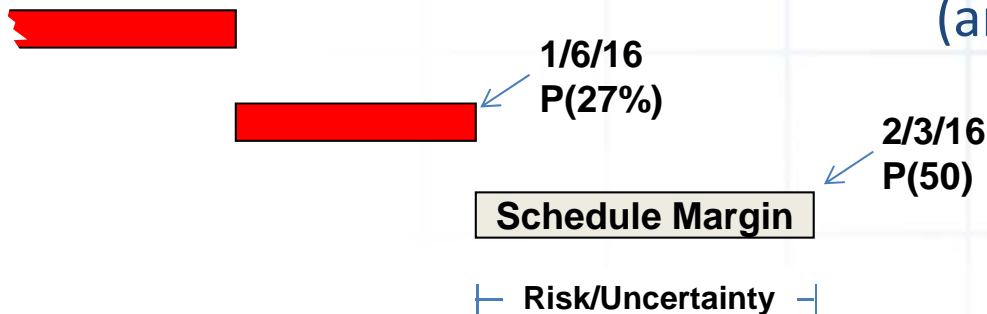
Why is a rapid SM decrease good?

With all else being equal (same critical path),

would a PM prefer to have a lot or risk/uncertainty?



or very little risk/uncertainty (and thus an earlier P(50) date)?



(Note: This is a simplistic generalization. Specific cases may need to be evaluated differently.)

Common (Contradictory) Perception of SM

Original Calculation (baseline):

“Schedule contingency should be calculated by performing a schedule risk analysis and comparing the schedule date with that of the simulation result at a desired level of certainty.” -GAO

Duration is a calculated assessment of risks and uncertainties (based on an SRA)

PM determines the acceptable risk level (P% date) which dictates the SM duration

Results in a more likely completion forecast

Recurring Calculation (forecast):

“...a delay in the finish date of the predecessor activity results in a reduction of the contingency activity’s duration.” -GAO

Duration may or may not be sufficient to adequately cover the current assessment of risks and uncertainties (not based on an SRA)

CAMs provide the status which drives the IMS deterministic finish and the SM duration

Results in a completion forecast “constrained” to the committed date

Q) Why is a change in SM philosophy needed on day 1?

A) It shouldn't be...