Quantitative Prediction and Improvement of Program Execution – A New Paradigm

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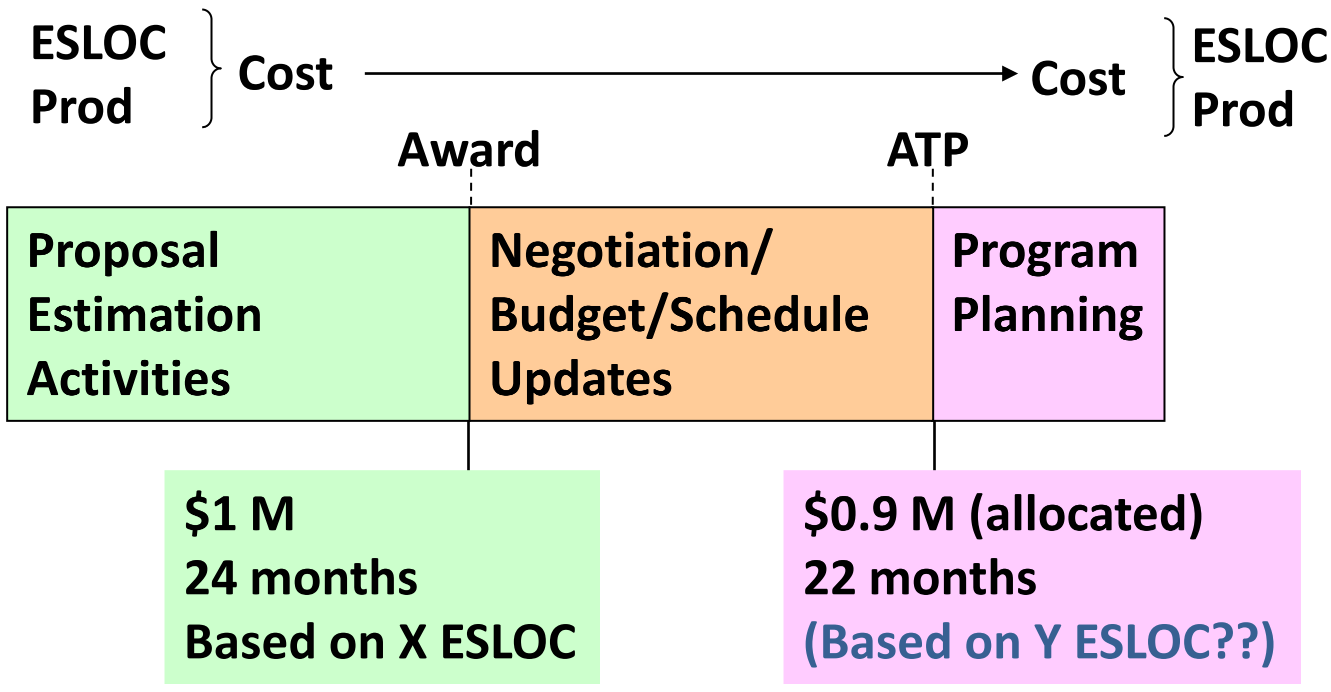
Agenda

- Problem
- Approach
- Process
- Examples Products
- Recommended Practices and Lessons Learned
- Summary

Problem

Col Dave Madden:
“. . SW metrics are too rear view mirror - want projections into the future that we can measure ourselves against . . .”

Problem (Software Example)

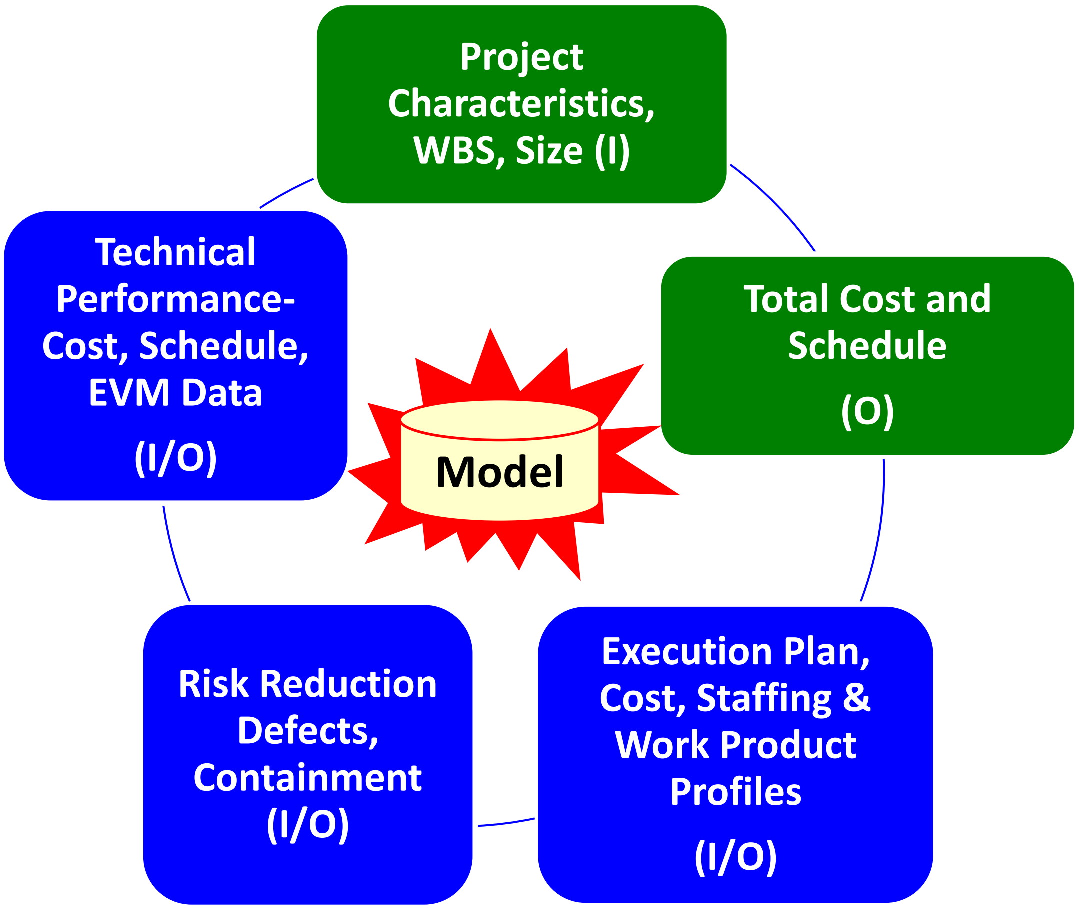


Value of the Proposal BOE is ignored/discarded after the Program is awarded

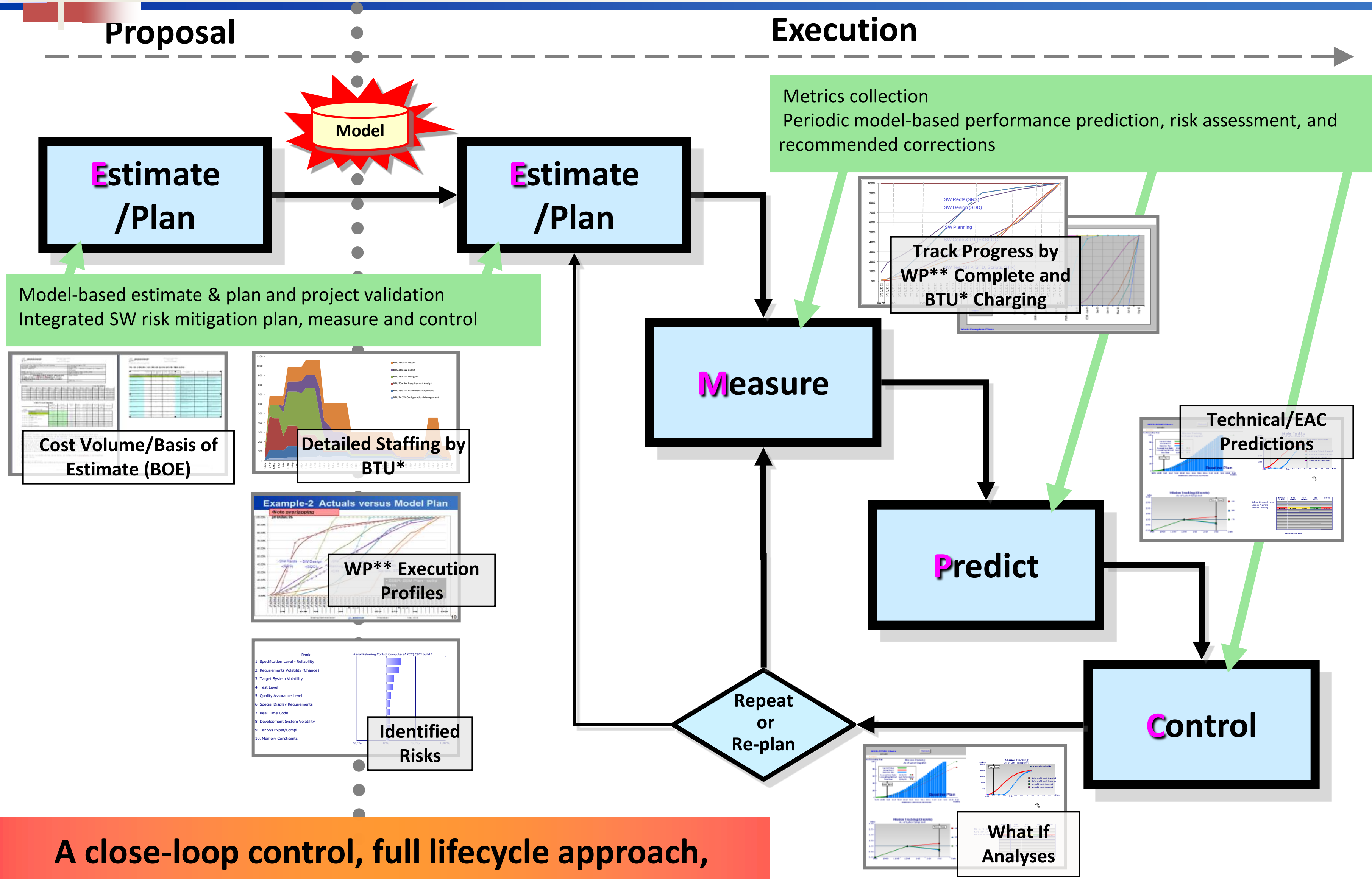
Approach: Integrated Model-based PM

Traditional: Estimating

Integrated Model-based PM Approach



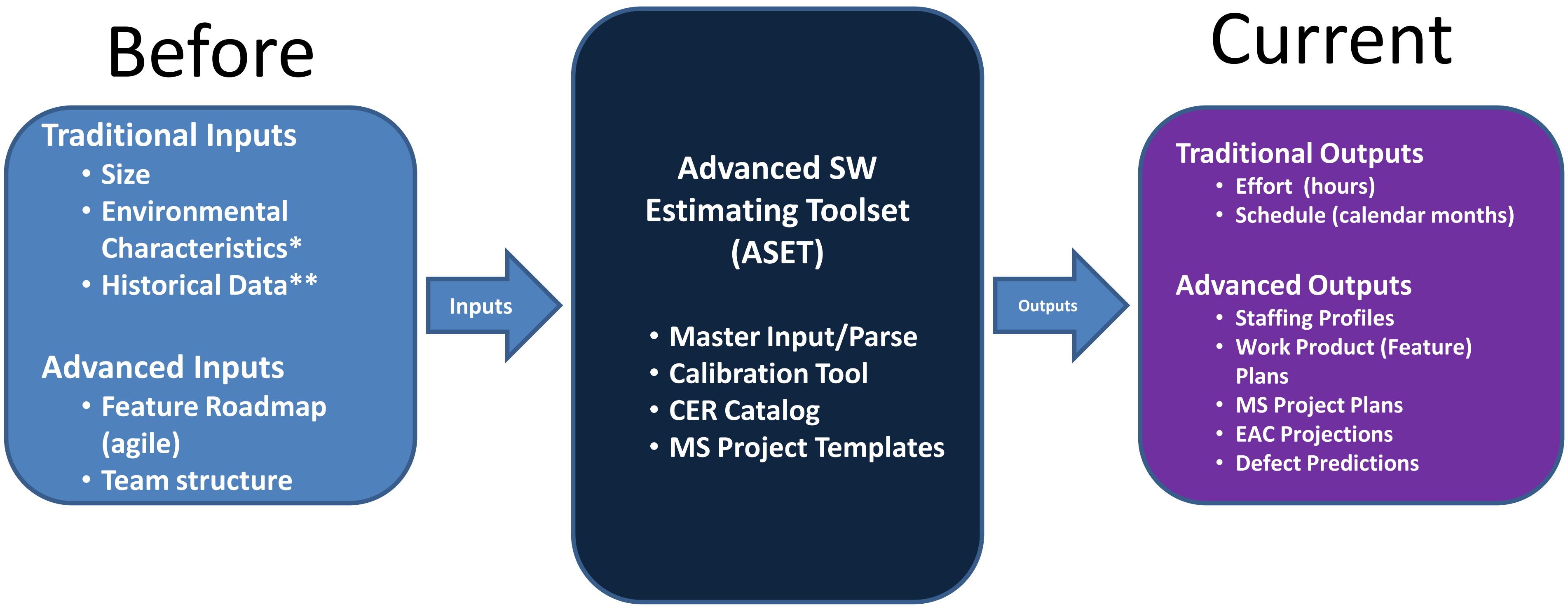
Process



A close-loop control, full lifecycle approach, for model-based, software project management

*BTU - Basic Task Unit, standard task based cost accounting structure
**WP – Work Product

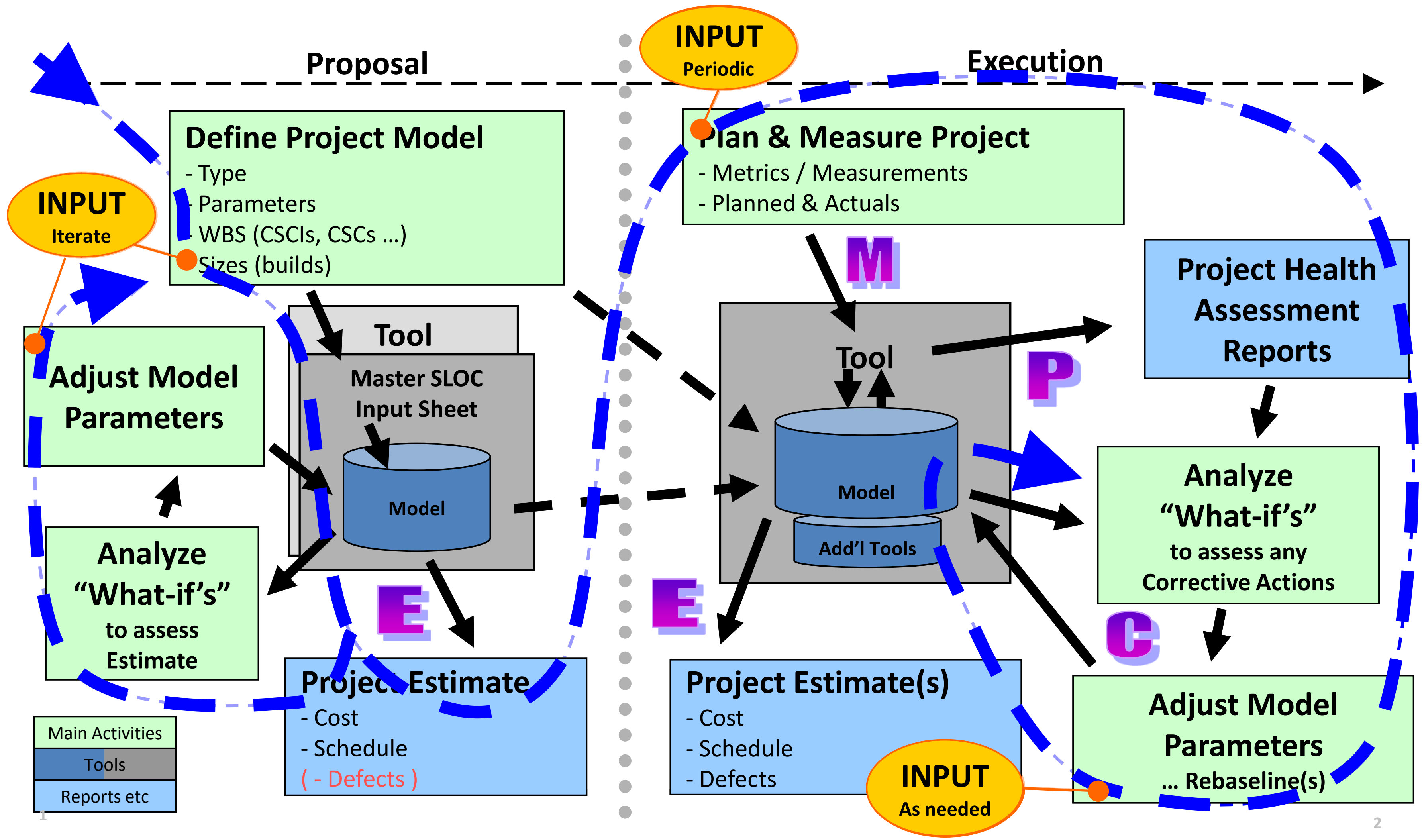
Improvements



* Environmental Characteristics include personnel, development / target / integration environments, and program constraints

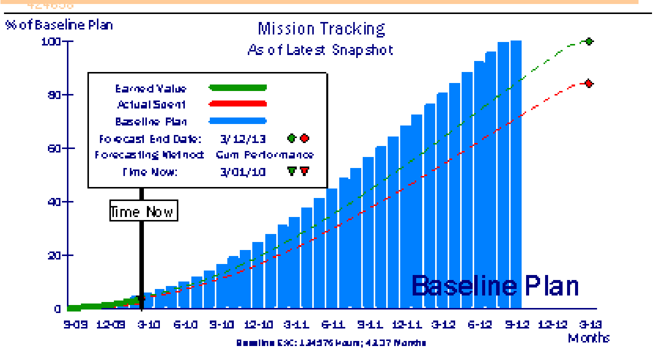
** Historical Data includes size, effort, schedule, and productivity and Cost Estimating Relationships (CERs)

Process Cycle



Capabilities and Products

Actual & Predicted Cost/Schedule versus Baseline Estimate



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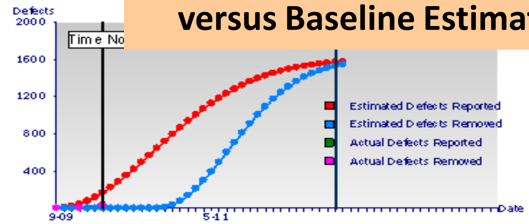
Actual Defects versus Baseline Estimate



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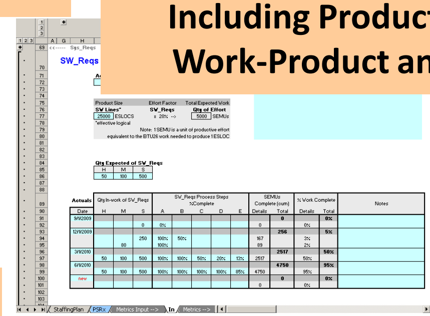
Technical Metrics/Analysis Including Productivity by Work-Product and Phase



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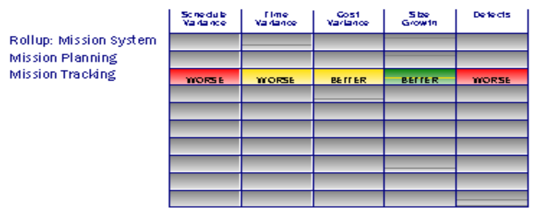
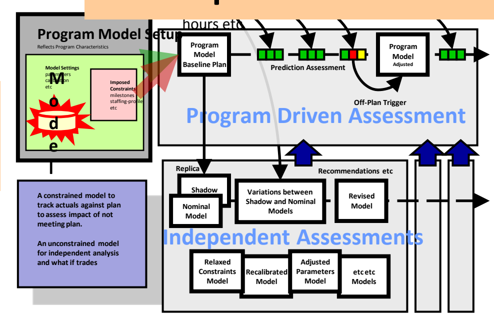
Summary Stoplight



Proposal Support, What-if Scenario & Independent Assessment



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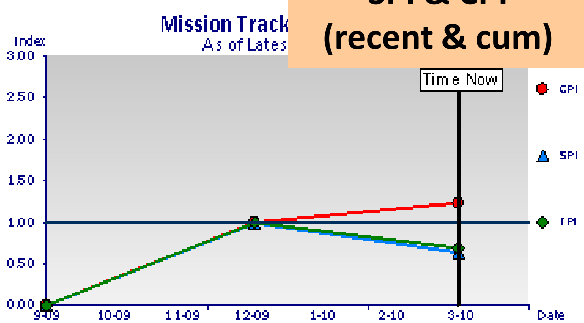
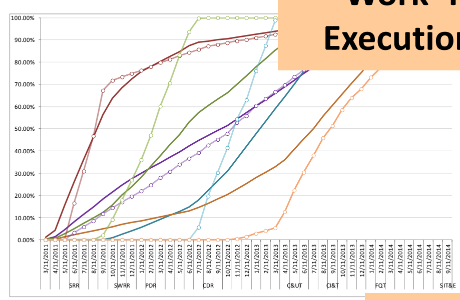
SPI & CPI (recent & cum)



Work- Product Execution Profiles



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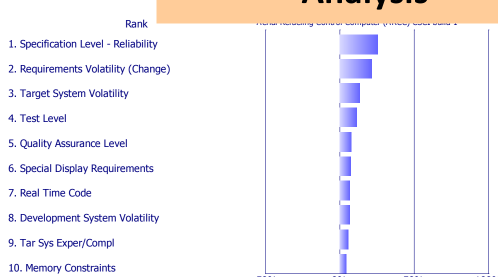
Risk Identification and Analysis



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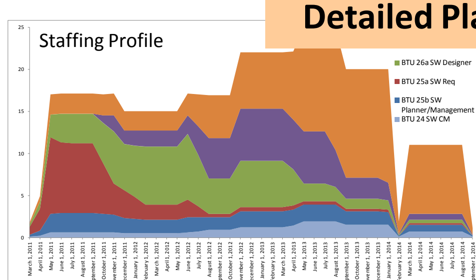
Detailed Plans



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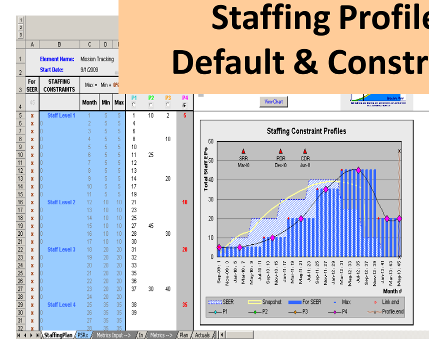
Staffing Profiles - Default & Constrained



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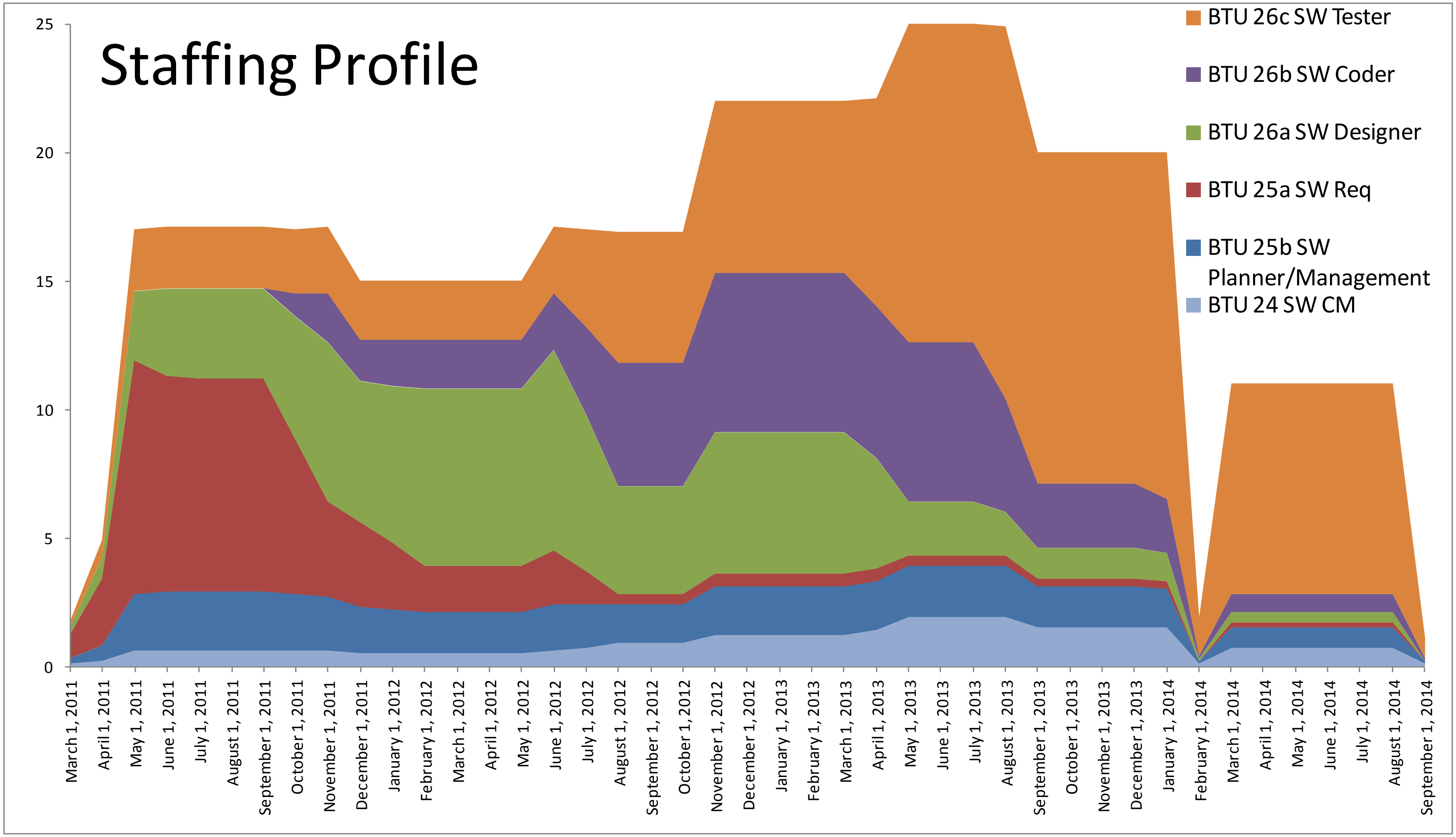
Sample Product



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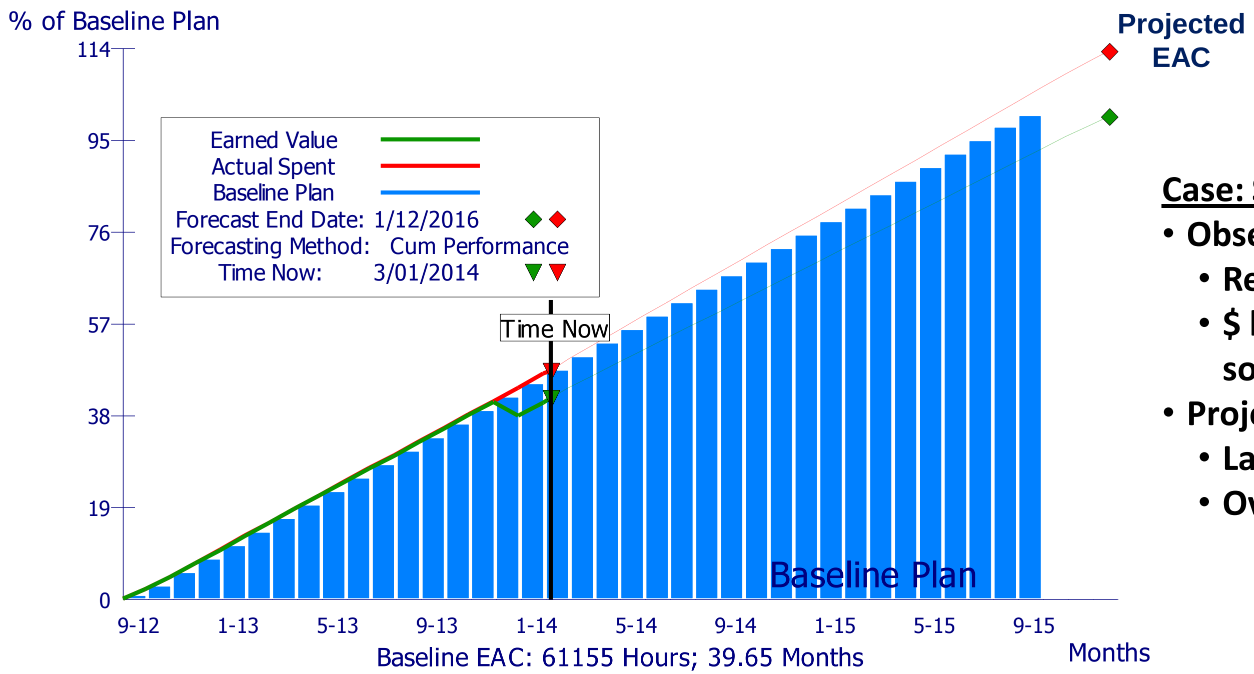
Execution Phase – Prediction Example



Case: Slow progress

- Observations
  - Reduced performance (green solid)
  - $ burn rate continues per plan (red solid)
- Projections (EAC)
  - Late to 100% done (green dotted)
  - Over budget (red dotted)

- **Based on actual performance data the model predicts cost overrun and late delivery**
- **'What if' analysis can help determine path back to within budget**
  - **Staff level**
  - **Personnel Characteristics**
  - **Development Environment**
  - **Target Environment**

Recommended Practice/ Lessons Learned -1

- **Process used in proposal phase creating representative model of project and plans applicable throughout lifecycle**
  - **Lesson: retrofitting during execution is cumbersome and costly**

- **Metrics Plans – Ensure proper information is available**
  - **Lesson: metric plans may not support desired performance management**

Recommended Practice/ Lessons Learned -2

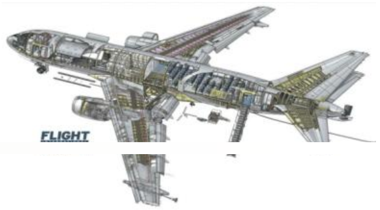
- Process should analyze metrics and cost data ensuring:
  - Cost charging alignment to WBS and use of BTUs are correct and support EVM analysis
  - Metrics are as planned and provide accurate assessment of program progress
  - Accurate and efficient historical data collection

- **Lesson: actual metric plan and cost charging vary from planned approach and may not provide needed information**

Recommended Practice/ Lessons Learned -3

- Process automation improves time and effort to produce plans, collect/analyze EVM, and prepare proposals
- Core SMEs support estimating and proposal development and mentoring of project personnel
  - Lesson: planning and monitoring is a time consuming activity for management resources, especially when doing re-plans during execution

Summary



- Integrated model-based project estimating, planning, predicting, tracking and management
- Carries value of proposal BOE through program execution
- Capability applied to software projects, expandable to SE
- Best if used in proposal phase and continued during contract execution
- Value proposition with metrics collection and process automation

Demonstrated Program Executability Improvements

Backup Information

Abstract

Quantitative Prediction and Improvement of Program Execution – A New Paradigm

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Flawless execution of programs is crucial for the US Government and its contractors. This presentation focuses on a "predictive methodology" that uses program data to provide leading indicators about the health of the program execution throughout the development cycle. While the methodology can be applied to an entire program, the initial focus has been on the "software" portion of a program (developed internally or by a supplier). Software implements complex system functionalities such as network operations and communications, system automation, control and autonomy, information assurance, data manipulation and management, and user interface capabilities. A number of DOD programs have experienced software related problems, including inaccurate and incorrect estimation of the software effort, lack of adequate and quantifiable definition of the planned work, and insufficient visibility and inaccurate measurement of the work performed. While methods based on Earned Value Measurement (EVM) have been in place for some time, they have proved to be insufficient for addressing the above problem. Specifically, the following contribute to the problem:
Lack of integrated leading indicators (based on the product size, cost, schedule, quality, and staffing requirements) to predict technical success of the software activities within a program.
Lack of value-added measures that provide predictive program insight while supporting lean improvements.
Lack of ability to effectively package and communicate the predicted program impact and recommended solutions to decision makers across the life cycle.

This presentation is based on the work done at Boeing to address the above issues. It covers:
A set of predictive metrics for software engineering, consistent with Government's predictive metrics for Probability of Program Success (PoPS) and Predictive System/Software Measurements (PSM).
A set of raw software measurements that can be used for estimation and measurement of detailed work planned and performed on government contracts.
A technical process that defines how software estimation, measurement, prediction, and control should be handled.
Extensibility of current metrics (e.g., EVM, quality, risk).
Information on how the process contributes to First Time Quality and Lean Program Management/Execution.
Information about the tool that automates the collection of the data and implementation of the process.
Use of the process and tool on trial projects and pilot programs
Lessons learned and future plan.

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