Does Use of Agile Practices Support Affordability?

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Objective/Outline

- **Software Affordability**
  - **Objective**
  - **Framework**
  - **Example outputs**

- **Model-based approach for quantitatively determining benefits of agile practices**
  - **Approach**
  - **Data**
  - **Results**
  - **Summary**

Affordability Objective: Develop Process, Techniques & Interactive Tool for

1. Identifying & Quantifying Affordability Opportunities

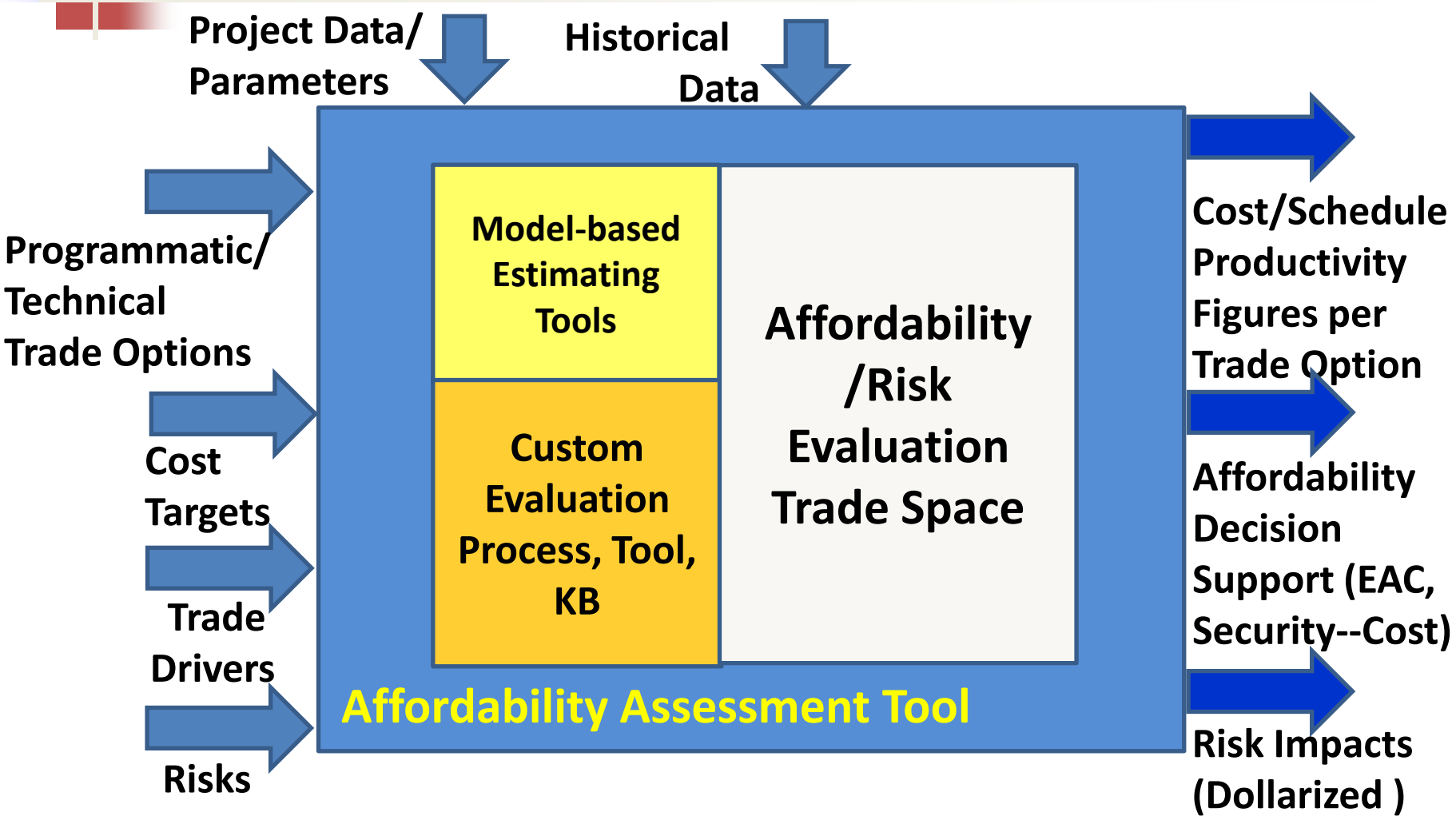
2. Performing Affordability Trades
   - Custom trade features

3. Assessing Risks and Issues
   - Technical/programmatic topics
   - Cost/schedule impact

4. Estimating, Capturing, and Evaluating Decision Impacts (similar to Risks)

5. Providing/supporting DtC, DfV, and CAIV Capabilities

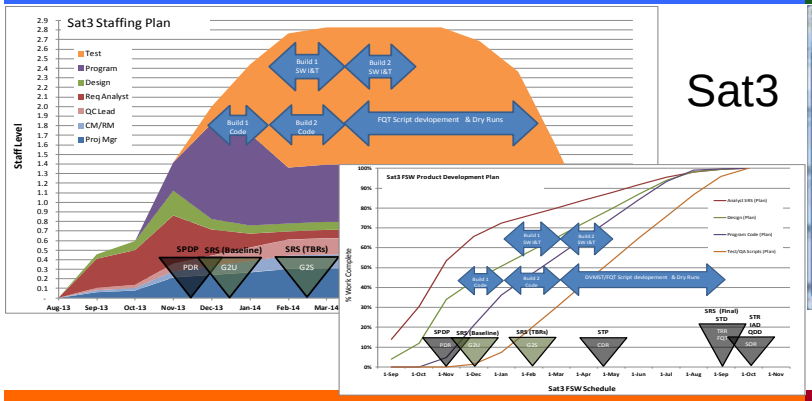
Affordability Framework



Software Focused, Extendable to Systems Engineering

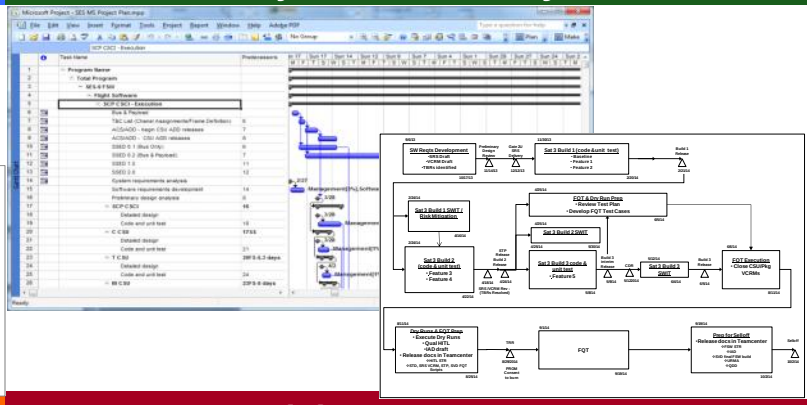
Trading Process and Outputs

Detailed Staffing Plan / % Work Product Complete

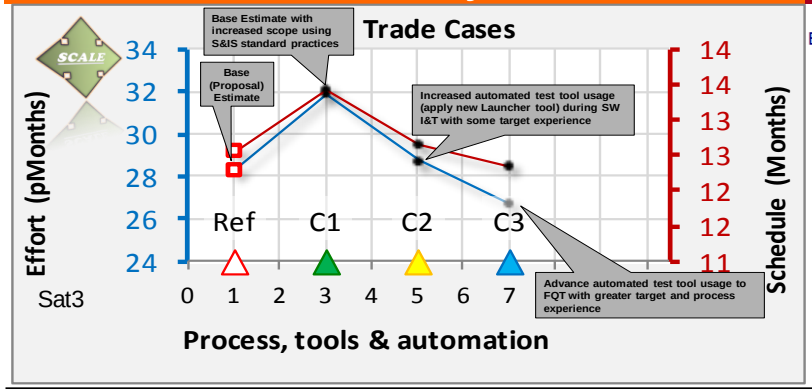


Sat3

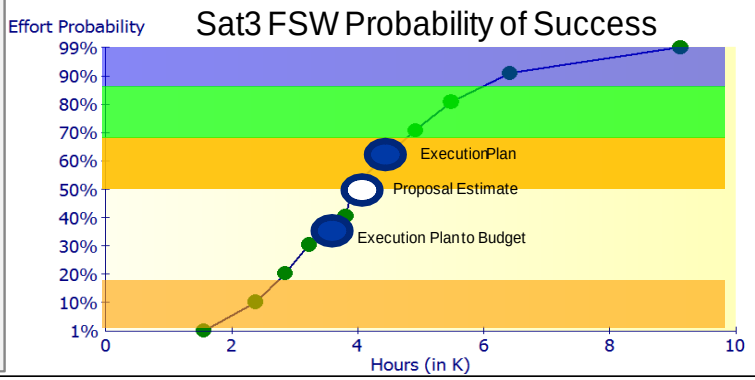
MS Project Plan/Activity Flow



SW Affordability Trade



Risk Assessment



Model for Quantitative Assessment of Agile Practices

Approach

- **Collect and analyze Agile Cost Reduction Data**
  - **Identify impact on cost reduction of basic characteristics provided in the data**
- **Use statistical analysis**

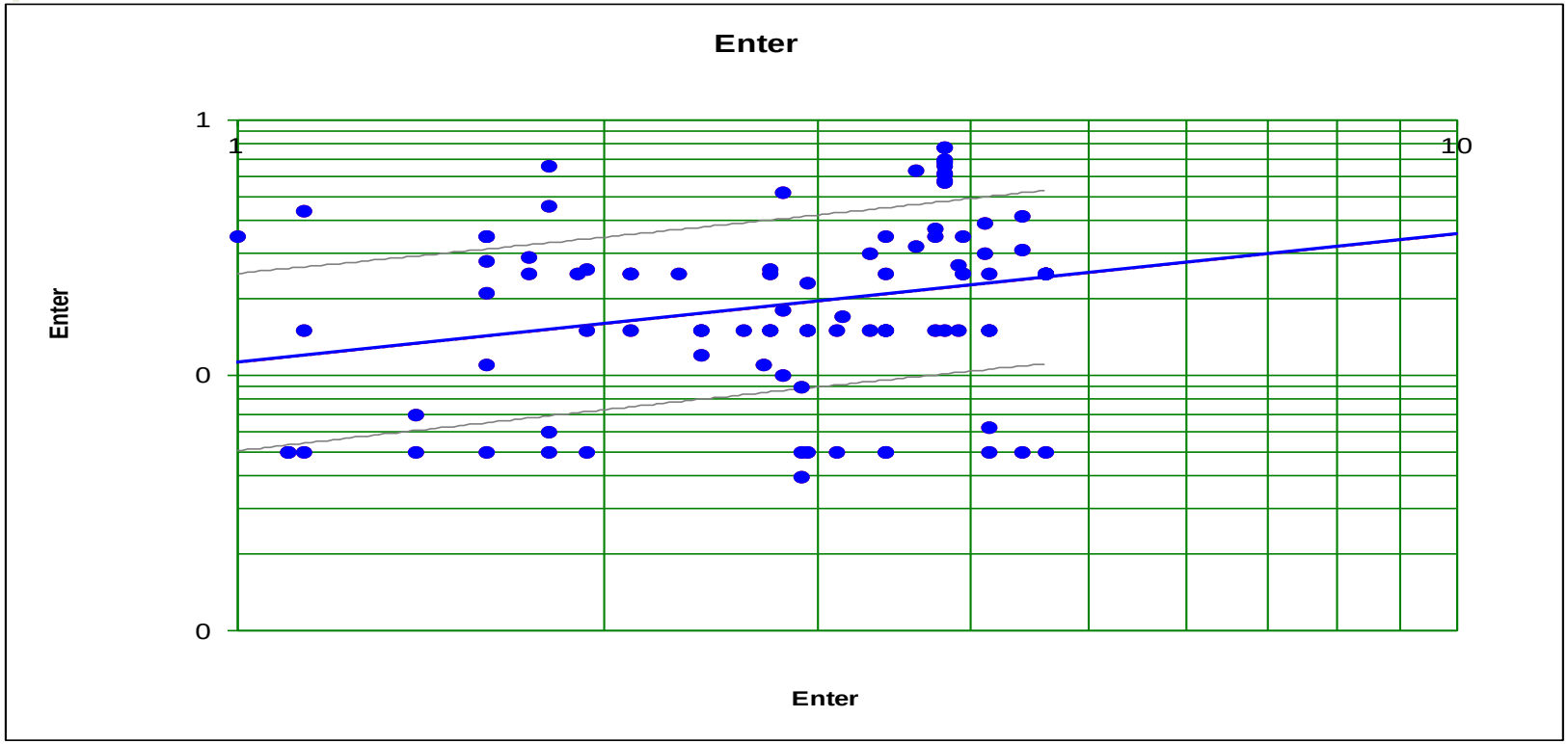
Empirical Data Analysis

- **The Data**
  - **Cost reduction data collected** from 103 projects performing agile practices
  - **Assuming all projects are utilizing SCRUM to qualify for inclusion**
  - **Source is either Engineering Judgment, Cost data, or Productivity values**

- **Attempted to quantify 5 potential cost impactors**
  - **Size (SLOC): small, medium, large**
  - **New /Follow-on**
  - **Continuous Integration**
  - **Automated Testing**
  - **Development Environment Change**
  - **Team Capability**

- **Analysis included**
  - **Correlation matrix**
  - **Subset averages**
  - **Regression Analysis**

Regression Analysis



- These results suggest factors that can be used in a model: SCRUM, Continuous Integration, and Automated Testing
- Strong correlation between Continuous Integration and Automated Testing suggest if adopt one will adopt both

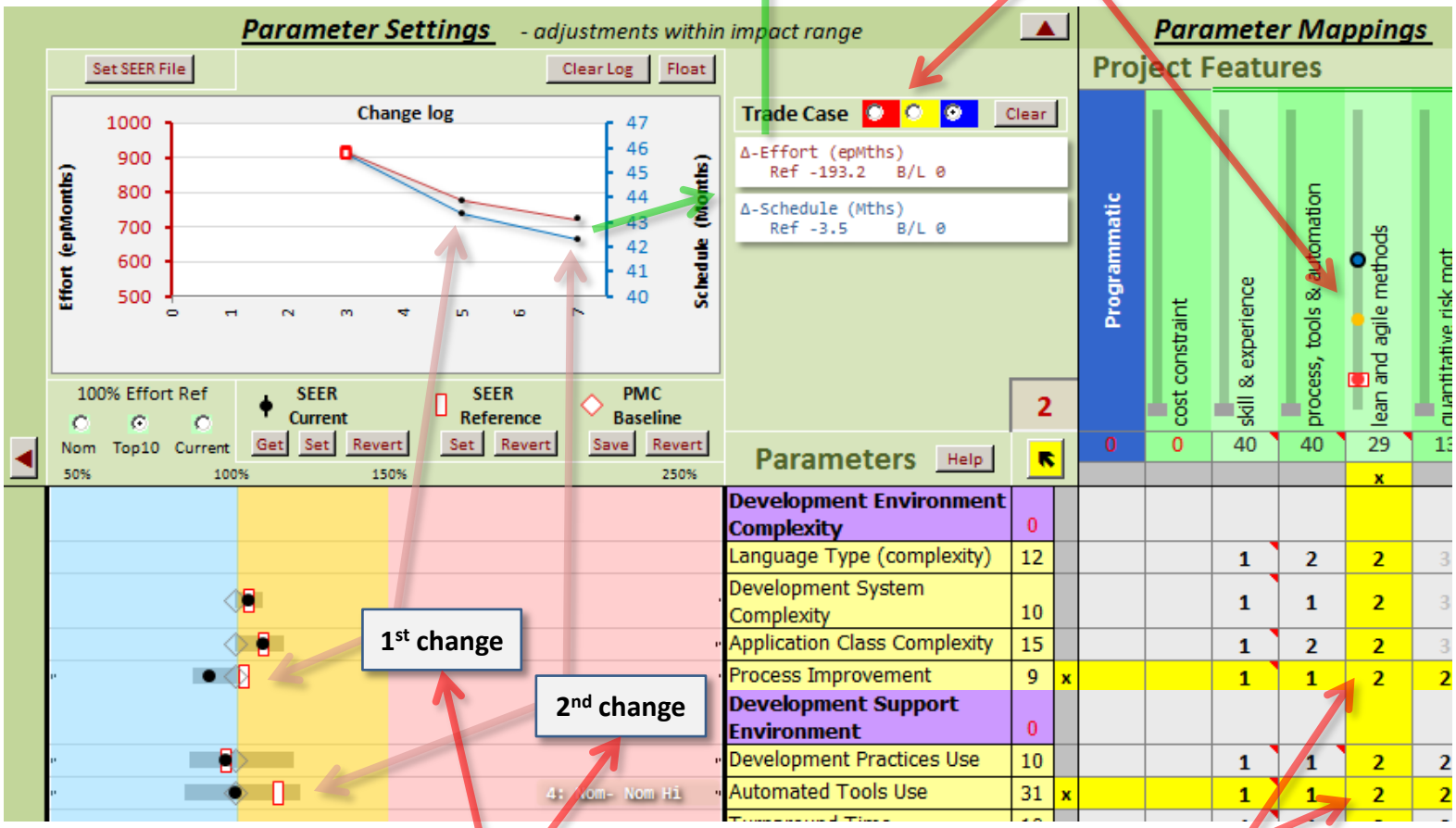
Agile Software Data

Results (December 31, 2013 version)

Platform / Source	Average Cost Reduction	Domain Expertise	Follow-on Development	Significant Environment Changes	Automated Testing	Continuous Integration
Avionics	32%	Very High	Most	Some	Most	Most
Cyber Security	20%	High	Some	Most	Most	Most
Ground Mission Critical	20%	High	None	Most	Most	Some
Ground Mobile	20%	Nominal	Most	Some	All	All
Ground Non –Mission Critical	19%	High	Some	Some	Some	Most
Manned Space	5%	High	Some	Some	Some	Some
Missile	17%	High	Some	All	Some	Some
Simulation	20%	High	All	Some	Some	Some
Unmanned Space	18%	High	Some	Some	Some	Some
Web Development	52%	Very High	None	All	None	None
Overall Average (of all projects submitting data) Middle 50th percentile:	**24%** 12%-32%	Other benefits: higher quality, customer and employee satisfaction, improved visibility, improved communication, lower risk, earlier working product				

Use of Agile within Affordability Framework (Notional)

- Example shows:
  - Effort reduced -- 193 Person Months (21%)
  - Schedule reduced -- 3.5 months (8%)



Summary

Data is sufficient for simple modeling

- **Data allows for subset analysis to assess impact of various factors, e.g., impact of AT/CI**

Data does support assumptions of cost reduction

- **Agile reduces cost**
- **Small programs have greater reduction**
- **Personnel characteristics are significant factor**
- **Automated Testing and Continuous Integration tend to be adopted together and do reduce cost**

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Backup Information

Abstract

Affordability is a key driver in today's DOD environment and impacts the DOD contractors and supply chain. Use of agile software engineering practices has shown encouraging results within the community. However, collecting, evaluating, and validating empirical data that shows the quantitative impacts and benefits of using agile practices has been challenging. This presentation describes a framework for performing trades in support of affordability goal settings, assessments and decisions. It then describes how the use of agile practices can be used within the framework. Specifically, it describes (a) the approach for collecting and analyzing the empirical data from a set of agile software development projects, (b) the statistical parametric model used for capturing and presenting the characteristics of the agile projects, and (c) the quantitative results of the study. The presentation also describes the challenges and lessons learned from this study, how quantitative results are used within the affordability framework, and the forward plan for improving the overall capability.

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