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True Program Success™

A Process for Mapping COCOMO Input Parameters to True S Input Parameters

Agenda

- Overview
- Rosetta Stone COCOMO II – True S
- Analysis
- Summary

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Overview

- Initial Comparison and Assessment was Completed by USC Center for Systems & Software Engineering
  - Initial Study was Limited to a COCOMO Viewpoint Only
- Analysis was Completed using the same Data the initial analysis used
- Results are More Granular

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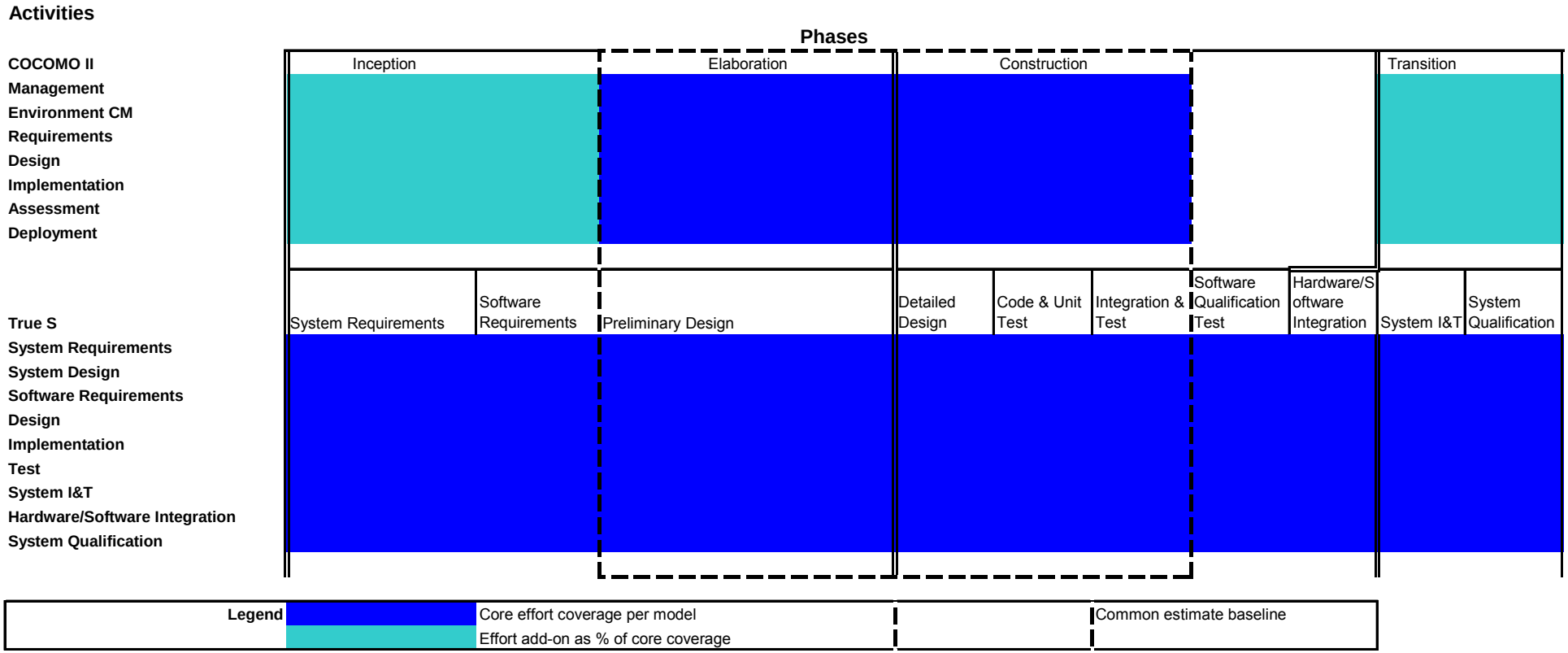
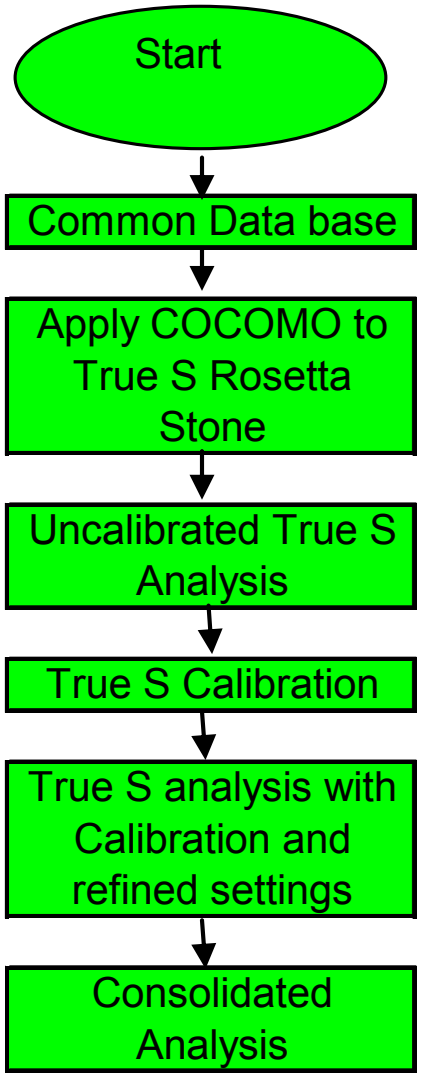
Example: WBS Mapping



Model Analysis Flow



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COCOMO to True S Mapping

COCOMO			True S	
Parameter		**Value**	**Parameter**	**Value**
Precedentedness Rating	PREC	→	No direct True S Input Parameter	Accounted for in Adapted Design, Code, & test, along with software size reuse, and integration
Development Flexibility	FLEX	→	No direct True S input Parameter	Accounted for in Organization productivity, development team complexity, project complexity, and operating specification
Architecture/Risk Resolution	RESL	→	No direct True S input Parameter	Accounted for in # of Equivalent Requirements, Requirements Stability, COTS Tailoring and Evaluation inputs

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Team Cohesion	TEAM	→	Stakeholder Involvement	
		Very Low		None
		Low		Minimal
		Nominal		Minimal
		High		Moderate
		Very High		Complete
		Extra High		Complete

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Process Maturity	PMAT	→	Organizational Productivity	
		Very Low/Low		CMM Level 1
		Nominal		CMM Level 2
		High		CMM Level 3
		Very High		CMM Level 4
		Extra High		CMM Level 5

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Required Software Reliability	RELY	→	Operating Specification	
			Very Low	Commercial Proprietary Software: Informal Development
			Low	Commercial Proprietary Software: Formal Development - Nominal Reliability
			Nominal	Commercial Production Software: Nominal Reliability
			High	Commercial Production Software: High Reliability
			Very High	Military and Commercial aviation
			Extra High	Space

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Data Base Size	DATA	→	Internal & External Integration	
		Very Low		Very Low
		Low		Low
		Nominal		Nominal
		High		High
		Very High		Very High
		Extra High		None

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Product Complexity	CPLX	→	Functional Complexity	
		Very Low		1.59
		Low		2.31
		Nominal		3.15
		High		4.90
		Very High		7.77
		Extra High		10.95

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Developed for Reusability	RUSE	→	Design for Reuse	
		None		No design for reuse
		Across Project		Nominal reuse/low impact reuse
		Across Program		Reuse plans for a few selected parts of the application
		Across Product Line		Reuse plans for much of the application with more than one project
		Across Multiple Product Lines		Significant reuse across multiple projects

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Documentation Match to Life-Cycle Needs	DOCU	→	No Direct True S input Parameter	Accounted for in Operating Specification, amount of new software, design for reuse, and organizational productivity
Execution Time Constraints	TIME	→	Project Constraints	
		Very Low, Low & Nominal		0.50
		High		0.65
		Very High		0.70
		Extra High		0.85
Main Storage Constraint	STORE	→	Project Constraints	This input was consolidated with Time

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Platform Volatility	PVOL	→	Hardware Platform Stability & Hardware Platform availability	
			Very Low	N/A
			Low	N/A
			Nominal	Very Stable - Hardware Exists and is Functional/Available more than 95% of the time
			High	Moderately Stable - New hardware, Well Tested/ Available 50% to 75% of the time
			Very High	Unstable - Hardware Developed in Parallel/Available less than 50% of the time
			Extra High	N/A

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Analyst Capability	ACAP	→	Development Complexity/Analyst Capability	
		Very Low		Novice
		Low		Still Learning
		Nominal		Capable
		High		Highly Capable
		Very High		Expert
		Extra High		Expert

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Programmer Capability	PCAP	→	Development Complexity/ Programmer Capability	
		Very Low		Novice
		Low		Still Learning
		Nominal		Capable
		High		Highly Capable
		Very High		Expert
		Extra High		Expert

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Personnel Continuity	PCON	→	Development Complexity/ Team Continuity	
		Very Low		> 20% Turnover
		Low		10% - 20% Turnover
		Nominal		5% - 10% Turnover
		High		3% - 5% Turnover
		Very High		< 3% Turnover
		Extra High		< 3% Turnover

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Application Experience	APEX	→	Development Complexity/ Familiarity with Product	
		Very Low		Novice
		Low		Less Than 2 Years
		Nominal		2 5 Years
		High		5 – 10 Years
		Very High		More Than 10 Years
		Extra High		More Than 10 Years

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Platform Experience	PLEX	→	Development Complexity/ Familiarity with Development Platform	
		Very Low		Novice
		Low		Less Than 2 Years
		Nominal		2 5 Years
		High		5 – 10 Years
		Very High		More Than 10 Years
		Extra High		More Than 10 Years

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Language & Tool Experience	LTEX	→	Development Complexity/ Experience with Language	
		Very Low		Novice
		Low		Less Than 2 Years
		Nominal		2 5 Years
		High		5 – 10 Years
		Very High		More Than 10 Years
		Extra High		More Than 10 Years

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Use of Software Tools	TOOL	→	Design/Code/Test Tools	
		Very Low		Stand Alone
		Low		Minimal Integration
		Nominal		Nominal
		High		High Integration
		Very High		Complete Integration
		Extra High		Complete Integration

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Multi-site Development	SITE	→	Multiple Site Development	
		Very Low		Multi-national project with many communication challenges
		Low		Team in many locations with few communication challenges
		Nominal		Entire team located in same place
		High		Team in several locations with no focus on communications
		Very High / Extra High		Team in several locations with communications a high priority

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COCOMO to True S Mapping

COCOMO			True S	
Parameter		Value	Parameter	Value
Requirements Development Schedule	SCED	→	No direct True S Input Parameter	Accounted for by entering schedule dates

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Performance Measures

- Compare Actual and Estimated Effort for n Projects in Dataset

Relative Error (RE) = (Estimated Effort – Actual Effort) / Actual Effort
Magnitude of Relative Error (MRE) = I Estimated Effort – Actual Effort I / Actual Effort
Mean Magnitude of Relative Error (MMRE) = (∑ (MRE) / n
Root Mean Square (RMS) = ((1/n) ∑ (Estimated Effort – Actual Effort)$^{2)\ ½}$

Where k = the number of projects in a set of n projects whose MRE <=L

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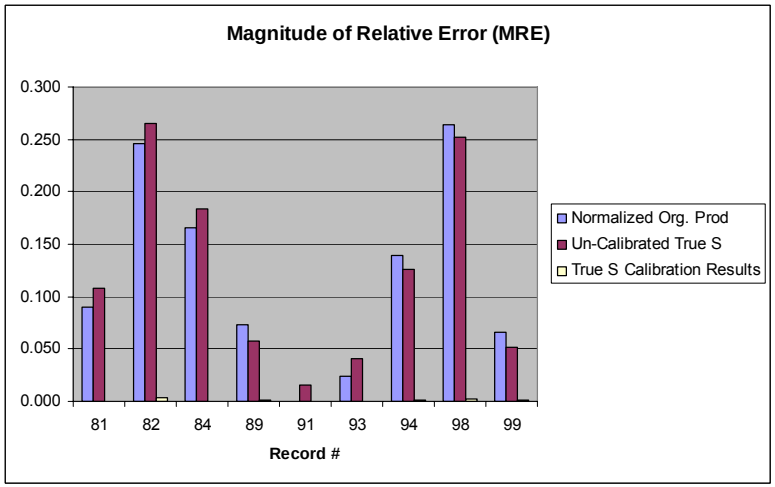
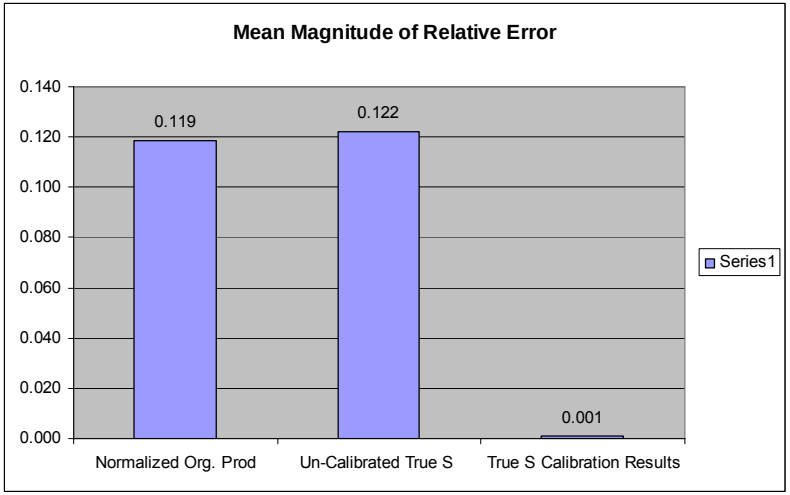
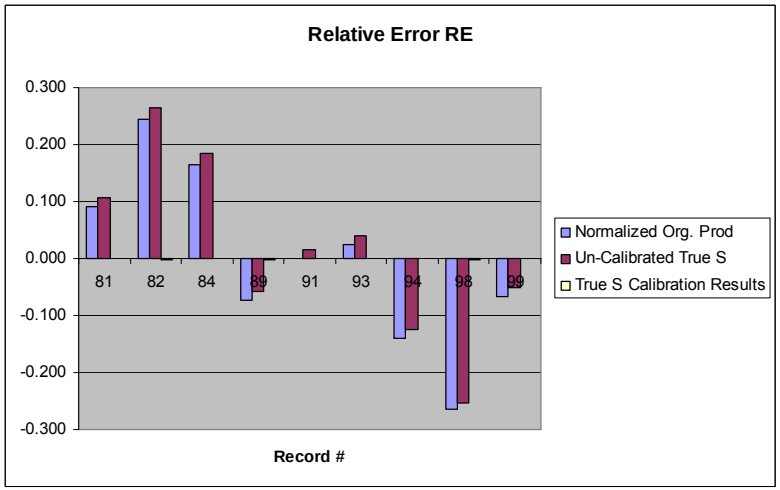
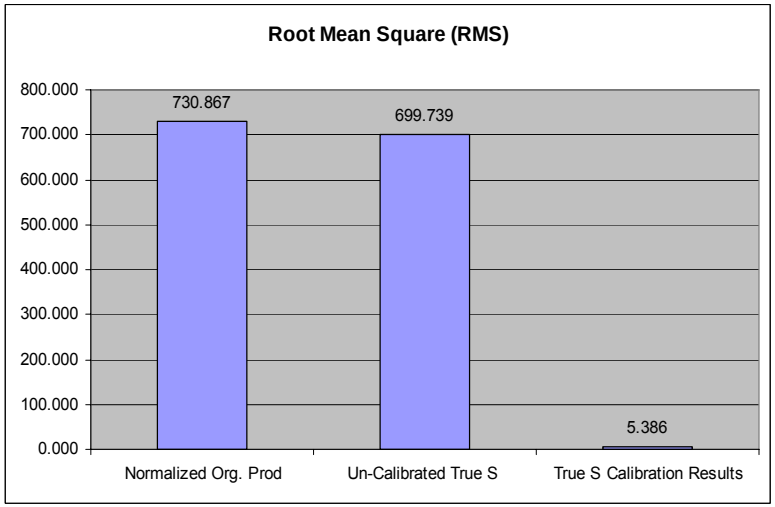
True S Performance Examples





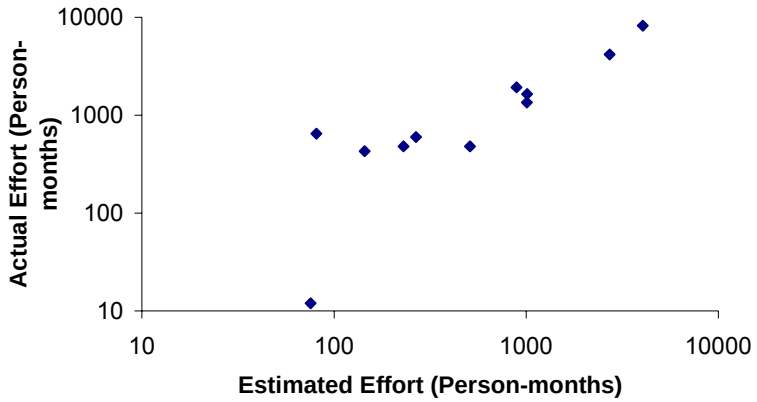




COCOMO II Performance Examples

Dataset Name: NASA 94
Category: Avionics
Mode: Embedded
Number of projects = 11

Effort Estimates vs. Actuals

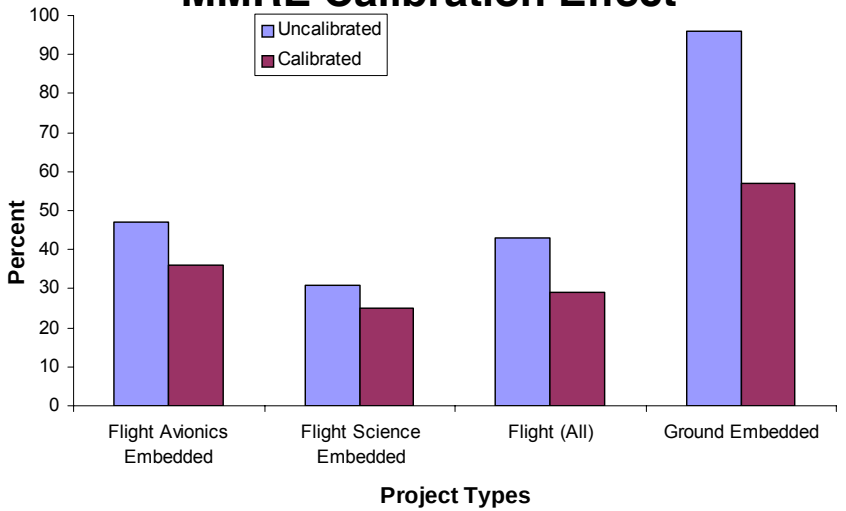


Effort Prediction Summary

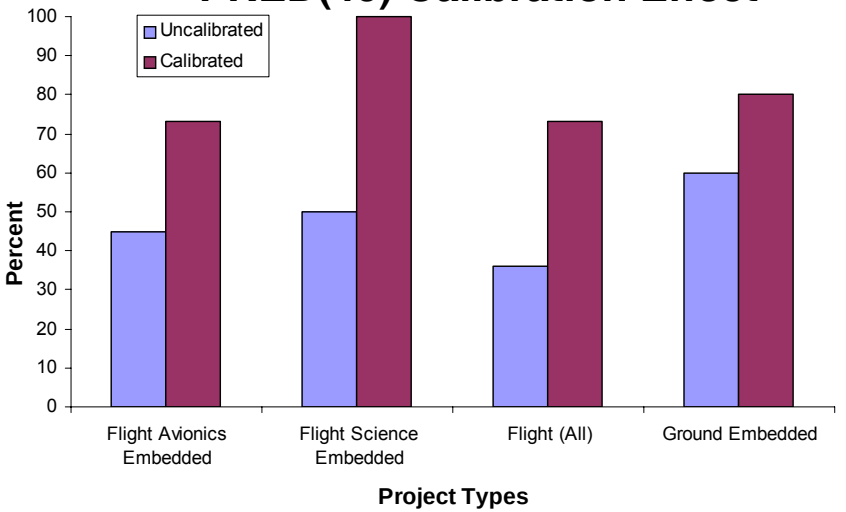
Calibrated	
MMRE	55%
RMS	433.0
PRED(10)	12%
PRED(20)	19%
PRED(30)	45%
PRED(40)	65%

Uncalibrated	
MMRE	91%
RMS	1404.4
PRED(10)	9%
PRED(20)	9%
PRED(30)	18%
PRED(40)	36%

MMRE Calibration Effect



PRED(40) Calibration Effect



Summary

- Detailed Rosetta Stone Developed for COCOMO to True S Input Parameters
- Allows for Generating Two Software Model Estimates Two Different Software Model Methodologies using One Input Parameter Data Set

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