



# USC CORADMO.2001: A Software Cost Model Implementation for RAD

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# Outline

Introduction

Delphi Results

Implementation

Conclusions

Demonstration

# Introduction

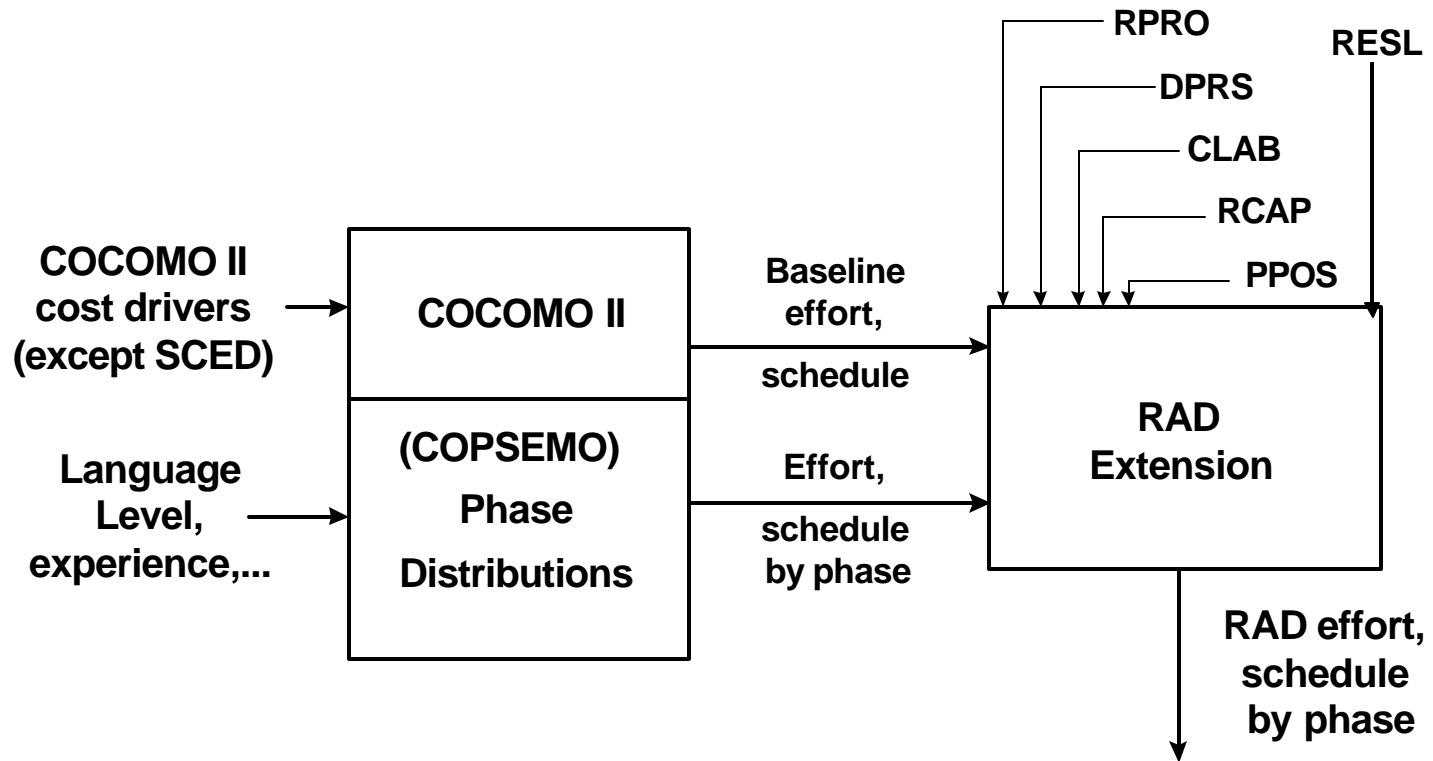
## **RAD (Rapid Application Development)**

- an application of any of a number of techniques or strategies to reduce software development cycle time

## **Constructive Rapid Application Development Model:**

- Calculates/predicts
  - schedule (months, M)
  - personnel (P)
  - adjusted effort (person-months, PM)
- Based on
  - the planned or expected distribution of effort and schedule to the phases (Inception, Elaboration, Construction)
  - impacts of the selected schedule driver ratings on the M, P, and PM of each phase

# CORADMO Logical Model

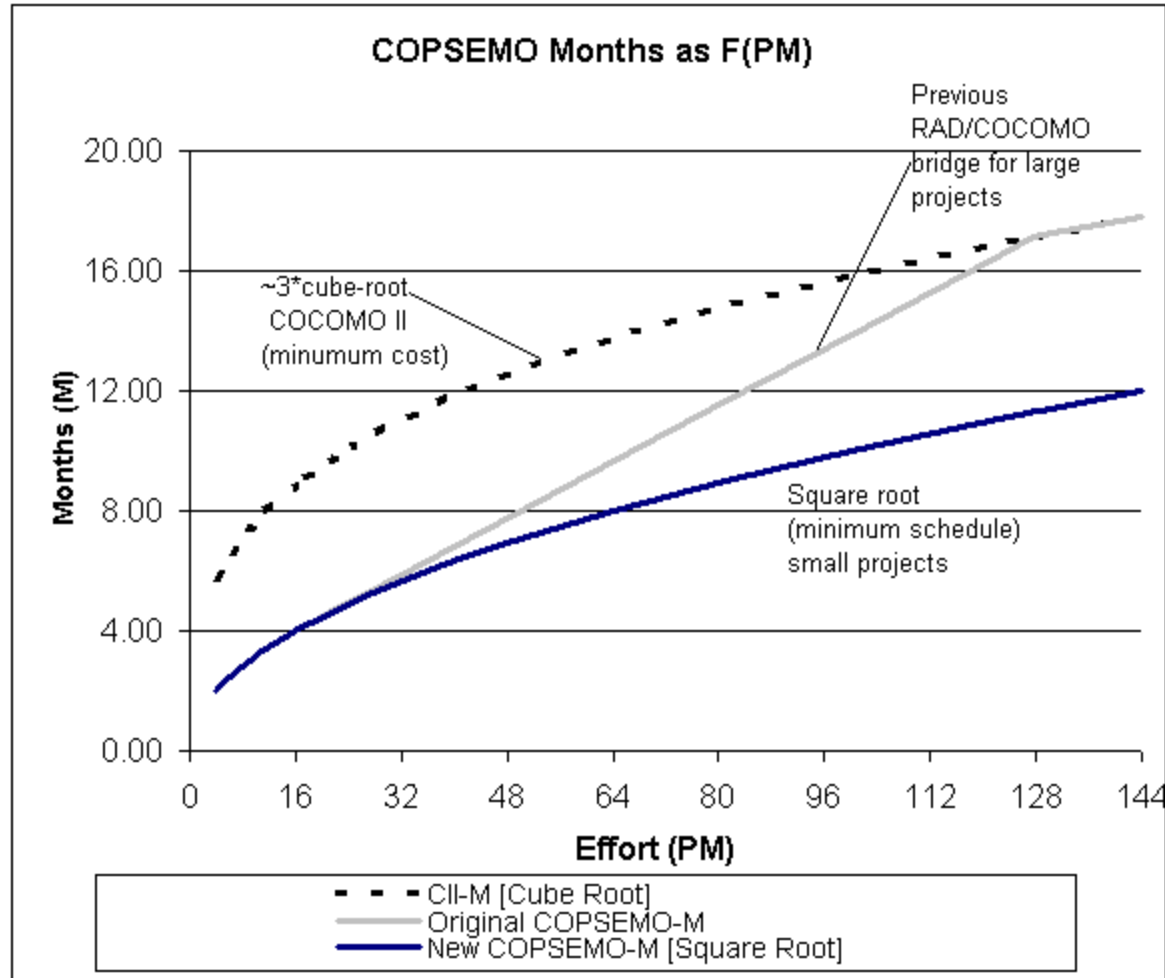




# RAD Opportunity Tree

<b>Eliminating Tasks</b>	<ul style="list-style-type: none"> <li>— Business process reengineering - O</li> <li>— Development process reengineering - DPRS</li> <li>— Reusing assets - RPRO</li> <li>— Applications generation - RPRO</li> <li>— Design-to-schedule - O</li> </ul>
<b>Reducing Time Per Task</b>	<ul style="list-style-type: none"> <li>— Tools and automation - O</li> <li>— Work streamlining (80-20) - O</li> <li>— Increasing parallelism - RESL</li> </ul>
<b>Reducing Single-Point Failure Risks</b>	<ul style="list-style-type: none"> <li>— Reducing failures - RESL</li> <li>— Reducing their effects - RESL</li> </ul>
<b>Reducing Backtracking</b>	<ul style="list-style-type: none"> <li>— Early error elimination - RESL</li> <li>— Process anchor points - RESL</li> <li>— Improving process maturity - O</li> <li>— Collaboration support - CLAB</li> </ul>
<b>Activity Network Streamlining</b>	<ul style="list-style-type: none"> <li>— Minimizing task dependencies - DPRS</li> <li>— Avoiding high fan-in, fan-out - DPRS</li> <li>— Reducing task variance - DPRS</li> <li>— Removing tasks from critical path - DPRS</li> </ul>
<b>Increasing Effective Workweek</b>	<ul style="list-style-type: none"> <li>— Prepositioning resources - PPOS</li> <li>— Nightly builds, testing - PPOS</li> </ul>
<b>Better People and Incentives</b>	<ul style="list-style-type: none"> <li>— Weekend warriors, 24x7 development - PPOS</li> <li>— More RAD experience - RCAP</li> </ul>
<b>Transition to Learning Organization</b>	<ul style="list-style-type: none"> <li>— O ACRONYM: CORADMO Driver</li> <li>— O: Other</li> </ul>

# New Duration Relationships



# Six RAD Drivers

- Extensions to COCOMO II
  - Rapid Prototyping (RPRO)
  - Development Process Reengineering (DPRS)
  - Collaboration Support & Experience (CLAB)
  - Architecture & Risk Resolution (RESL)
  - Pre-positioning Assets (PPOS)
  - RAD Capability of Personnel (RCAP)

# Delphi Results

- Delphi Exercise Forms distributed
- RAD Experts from Industry and Academia
  - Affiliates, Professors, and Researchers
- Two rounds completed
- EMR (Effort Multiplier Range)
  - Highest/Lowest across the rating scale for effort
- SMR (Schedule Multiplier Range)
  - Highest/Lowest across the rating scale.

## % Effort per phase

	ROUND 1		ROUND 2	
	Mean	Standard Deviation	Mean	Standard Deviation
<b>Inception – I</b>	10.29	4.75	8.50	3.89
<b>Elaboration – E</b>	23.71	5.38	23.67	4.23
<b>Construction – C</b>	71.29	12.00	76.33	4.23
<b>Total I, E &amp; C</b>	105.29	4.24	108.50	3.89

## % Schedule per phase

	ROUND 1		ROUND 2	
	Mean	Standard Deviation	Mean	Standard Deviation
<b>Inception – I</b>	15.71	4.99	14.17	3.43
<b>Elaboration – E</b>	29.86	5.64	29.67	6.28
<b>Construction – C</b>	63.14	11.94	70.50	6.16
<b>Total I, E &amp; C</b>	108.71	6.94	114.33	3.61

# Rapid Prototyping

Expresses the degree to which prototyping is utilized

<b>Very Low</b>	<b>Low</b>	<b>Nominal</b>	<b>High</b>	<b>Very Low</b>
None	On average, personnel have experience on less than one recent project using Rapid Prototyping	Most personnel have worked on more than one project using Rapid Prototyping	On average, personnel have worked on more than two projects using Rapid Prototyping	All personnel have worked on at least three projects using Rapid Prototyping

# Delphi Results for RPRO

	ROUND 1				ROUND 2			
	EMR		SMR		EMR		SMR	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>I</b>	1.32	0.02	1.25	0.05	1.28	0.07	1.24	0.07
<b>E</b>	1.24	0.04	1.21	0.02	1.22	0.04	1.19	0.04
<b>C</b>	1.30	0.06	1.22	0.04	1.23	0.06	1.21	0.05

# Development Process Reengineering

Measures the degree to which the project and organization allow and encourage streamlined or reengineered development processes

<b>Very Low</b>	<b>Low</b>	<b>Nominal</b>	<b>High</b>	<b>Very Low</b>
Heavily Bureaucratic	Bureaucratic	Basic good business practices	Partly streamlined	Fully streamlined

# Delphi Results for DPRS

	ROUND 1				ROUND 2			
	EMR		SMR		EMR		SMR	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>I</b>	1.32	0.02	1.25	0.05	1.28	0.07	1.24	0.07
<b>E</b>	1.24	0.04	1.21	0.02	1.22	0.04	1.19	0.04
<b>C</b>	1.30	0.06	1.22	0.04	1.23	0.06	1.21	0.05

# Collaboration Support & Experience

Accounts for Multisite tool support plus special collaboration tools, yields a reduced effect on schedule and effort. Fuzzy average of two scales below.

Multisite	Very Low	Low	Nominal	High	Very High	Extra High
<b>SITE: Collocation</b>	International	Multi-city & Multi-company	Multi-city or Multi-company	Same city or metro area	Same building or complex	Fully collocated
<b>SITE: Communications</b>	Some phone, mail	Individual phone, FAX	Narrowband email	Wideband electronic communication	Wideband electronic communication, occasional video conferencing	Interactive multimedia

Collaboration Tools	Very Low	Low	Nominal	High	Very High
	None special	Common-access project files	Collaborative tool exercise: NetMeeting	Basic special collaboration support, e.g., GroupSystems.com	Advanced collaboration support: domain aids, agents

# Delphi Results for CLAB

	ROUND 1				ROUND 2			
	EMR		SMR		EMR		SMR	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>I</b>	1.34	0.09	1.27	0.13	1.38	0.09	1.33	0.13
<b>E</b>	1.23	0.07	1.23	0.06	1.29	0.06	1.26	0.06
<b>C</b>	1.23	0.08	1.21	0.05	1.22	0.04	1.21	0.05

# Architecture, Risk Resolution

## Delphi Results for RESL

(same as COCOMO II RESL)

	ROUND 1				ROUND 2			
	EMR		SMR		EMR		SMR	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>I</b>	1.10	0.08	1.07	0.05	1.05	0.05	1.05	0.05
<b>E</b>	1.10	0.08	1.09	0.08	1.06	0.07	1.06	0.08
<b>C</b>	1.13	0.10	1.21	0.12	1.08	0.10	1.11	0.12

# Prepositioning Assets

Degree to which assets are pre-tailored to a project and furnished to the project for use on demand

<b>Nominal</b>	<b>High</b>	<b>Very High</b>	<b>Extra High</b>
Basic project legacy, no tailoring	Some prepositioning & tailoring	Key items prepositioned & tailored	All items prepositioned & tailored

# Delphi Results for PPOS

	ROUND 1				ROUND 2			
	EMR		SMR		EMR		SMR	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>I</b>	1.12	0.02	1.22	0.02	1.13	0.11	1.17	0.12
<b>E</b>	1.14	0.04	1.23	0.02	1.16	0.08	1.21	0.06
<b>C</b>	1.18	0.05	1.26	0.03	1.21	0.07	1.26	0.04

# RAD Capability of Personnel

Personnel effects associated with the degree to which the personnel is familiar with RAD

<b>Very Low</b>	<b>Low</b>	<b>Nominal</b>	<b>High</b>	<b>Very High</b>	<b>Extra High</b>
25 <sup>th</sup> percentile	40 <sup>th</sup> percentile	55 <sup>th</sup> percentile	70 <sup>th</sup> percentile	85 <sup>th</sup> percentile	95 <sup>th</sup> percentile
≤2 months	4 months	6 months	1 year	3 years	6 years

# Delphi Results for RCAP

	ROUND 1				ROUND 2			
	EMR		SMR		EMR		SMR	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<b>I</b>	1.48	0.15	2.48	0.26	1.48	0.08	2.30	0.58
<b>E</b>	1.45	0.14	2.48	0.25	1.48	0.08	2.30	0.58
<b>C</b>	1.46	0.14	2.49	0.25	1.48	0.09	2.30	0.57

# Next Steps

- Perform Statistical Analysis
- Calibration
- Experiment
- Gather Data
- Perfect

# Conclusion

- Come a long way
- Got a long way to go
- Thanks to help
- Need your help
  - Data
  - Email: [fakharza@usc.edu](mailto:fakharza@usc.edu)