



UNIVERSITY OF
SOUTHERN CALIFORNIA

COTS-Based Systems (CBS) Total Lifecycle Effort Modeling with COCOMO II & COCOTS

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**GSAW 2001 - Business Breakout Group
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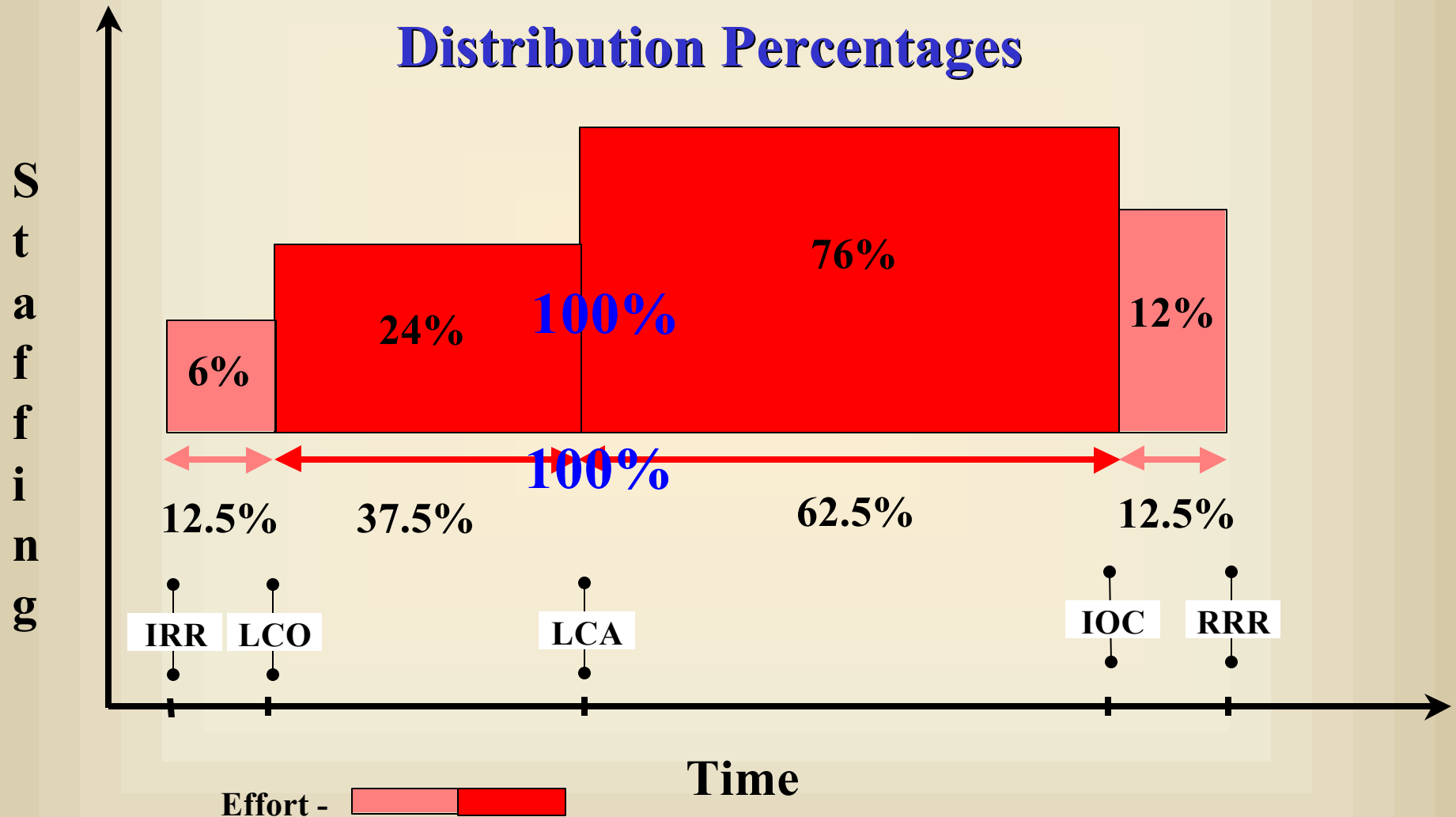
Feb. 21-23, 2001



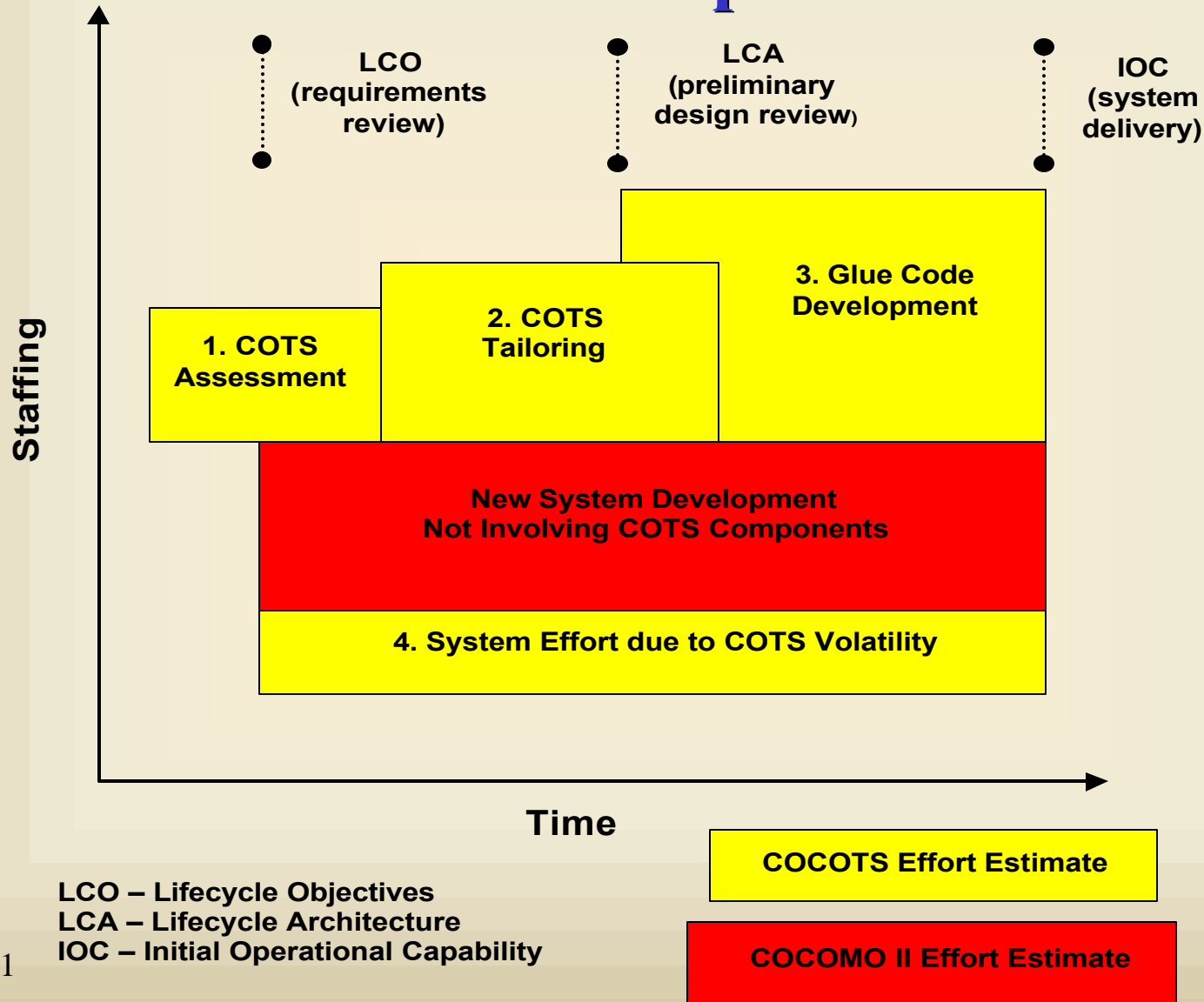
Briefing Outline

- **COCOMO II Modeling**
- **COCOTS: Development Model**
- **COTS Integration Effort Distributions**
- **COCOTS: Latest Glue Code Submodel Calibration**
- **COCOMO II/COCOTS Integrated Tool**
- **CBS Post-deployment Modeling Horizon**
- **Current Insights into Maintenance Phase Issues**
- **COCOTS: Maintenance Phase Straw Model**
- **COTS-LIMO: A CBS Economic Lifespan Model**
- **COCOTS Benefits**

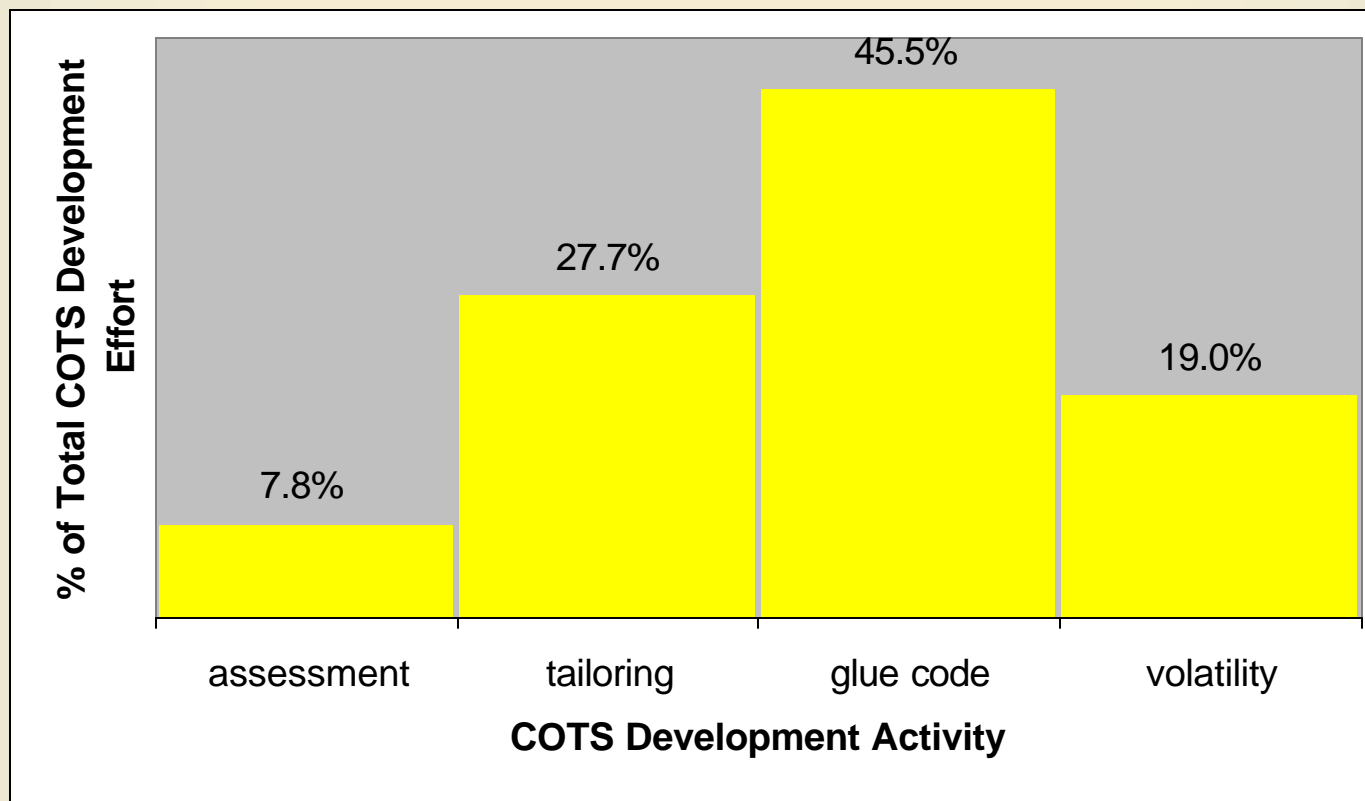
COCOMO II MBASE Effort & Schedule Distribution Percentages



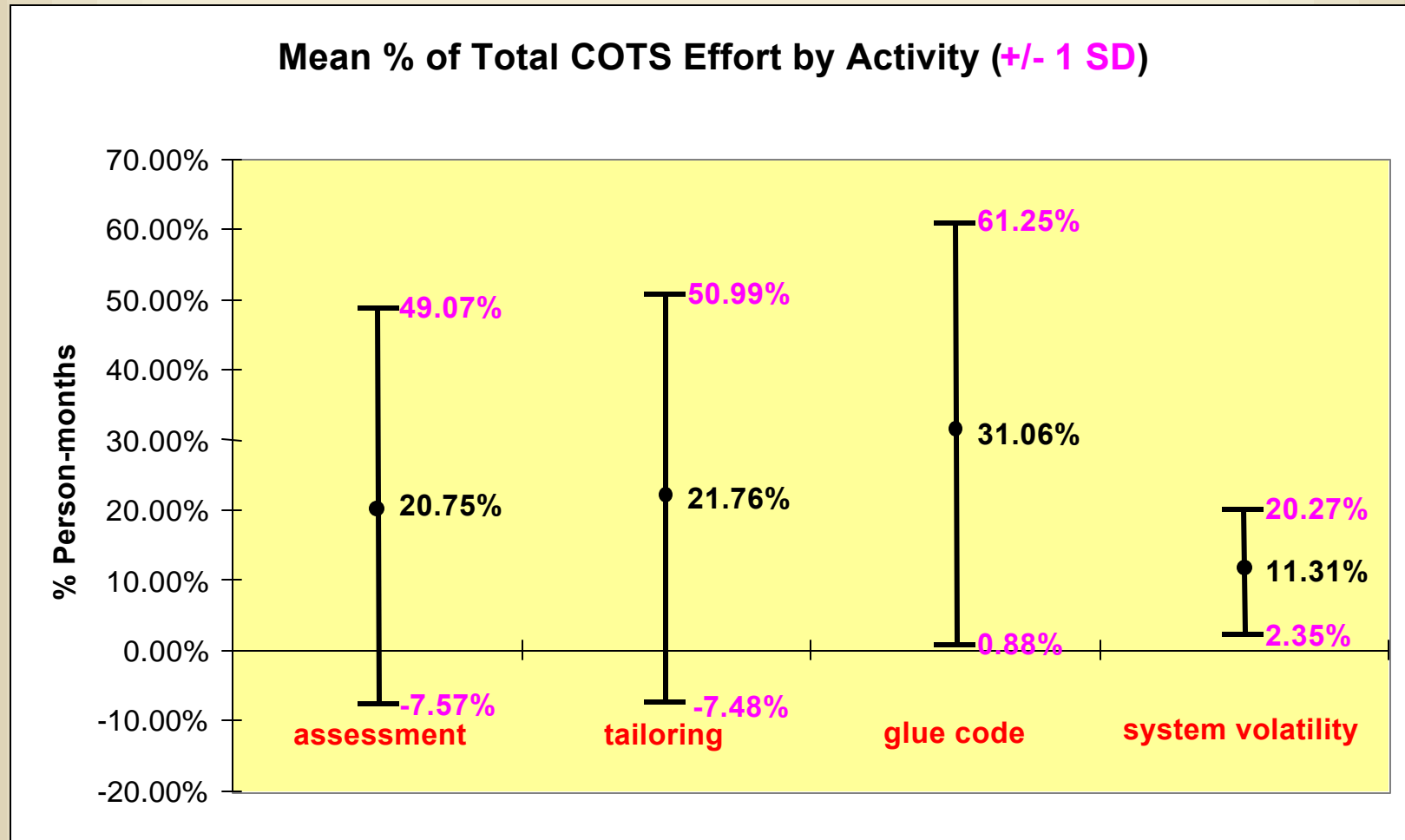
COCOTS: Development Model



Total COTS Development Effort Distribution



Average COTS Development Effort Distribution





New Glue Code Submodel Results

- **Current calibration looking reasonably good**
 - **Excluding projects with very large, very small amounts of glue code (Effort Pred):**
 - **[0.5 - 100 KLOC]: Pred (.30) = 9/17 = 53%**
 - **[2 - 100 KLOC]: Pred (.30) = 8/13 = 62%**
 - **For comparison, calibration results as of February 2000:**
 - **[0.1 - 390 KLOC]: Pred (.30) = 4/13 = 31%**
- **Propose to revisit large, small, anomalous projects**
 - **A few follow-up questions on categories of code & effort**
 - **Glue code vs. application code**
 - **Glue code effort vs. other sources**

New Glue Code Submodel Results (Detailed)

Overly large and small glue code projects set aside.				A=2.13		1.16.2001
PROJECT	eff size (ksloc)	B	xEAF	PM		%Rerr
				(est)	(rpt'd)	
B	468	1.04	0.510453806	650.7163767	60	984.53%
C	25	1.04	1.852572737	112.20507	75	49.61%
N3	20	1.04	0.322405591	15.48293759	12	29.02%
S	4.2	1.04	2.390191594	22.64600403	18	25.81%
P2	3	1.04	0.963253616	6.431708548	6	7.20%
Q	50	1	0.673812512	71.76103253	72	-0.33%
P5	5	1.04	1.006681407	11.4340597	12	-4.72%
G3	50	1.04	0.529078185	65.89132839	84	-21.56%
J	1.2	1.04	0.293750042	0.756320788	1	-24.37%
P1	10	1.04	0.380170097	8.878867139	12	-26.01%
E6	66	1.04	1.080272605	179.5720163	250	-28.17%
P3	30	1.04	0.417769338	30.58597083	60	-49.02%
M1	5	1.05	3.069851933	35.4336211	81	-56.25%
OO4	156.25	1	1.634415034	543.9537534	1411	-61.45%
K	1.5	1.04	0.444883317	1.444643319	4	-63.88%
A	8.05	1.06	0.204635155	3.976522848	12	-66.86%
L	1.3	1	0.586150455	1.62305061	7	-76.81%
HH1	1	1.07	0.337287985	0.718423407	6	-88.03%
D	6.2115	1	0.341574591	4.519200912	74	-93.89%
P4	0.2	1.04	0.455368578	0.181892109	6	-96.97%
Pred (.30) = 8/13 = 62%				Pred (.30) = 9/17 = 53%		8

COCOMO II-COCOTS Development Phase Tool

Project Information			
Project Title :	<input type="text" value="Test"/>	Project ID No.	<input type="text" value="1"/>
Date Prepared:	<input type="text" value="20-Nov-00"/>	Rev No.	<input type="text" value="0"/>
Originators	<input type="text" value="Tester Name"/>		
Please Select			
Overall Project			
<input type="button" value="DISPLAY OVERALL PROJECT SHEETS"/>		<input type="button" value="HIDE OVERALL PROJECT SHEETS"/>	
COCOMO II Effort Modelina			
<input type="button" value="DISPLAY COCOMO II SHEETS"/>		<input type="button" value="HIDE COCOMO II SHEETS"/>	
COCOTS Effort Modelina			
<input type="button" value="DISPLAY COCOTS SHEETS"/>		<input type="button" value="HIDE COCOTS SHEETS"/>	
Combined Schedule			
<input type="button" value="DISPLAY SCHEDULE SHEET"/>		<input type="button" value="HIDE SCHEDULE SHEET"/>	
Master Parameters			
*** FOR ADVANCED USERS ONLY ***			
To change driver values for various sub-models.			
<input type="button" value="DISPLAY MASTER PARAMETER TABLES"/>		<input type="button" value="HIDE MASTER PARAMETER TABLES"/>	

Current Insights into Maintenance Phase Issues

Priority of Activities by Effort Involved and/or Criticality

- **Higher**
 - training S C
 - configuration management C
 - operations support C
 - integration analysis S
 - requirements management S C
- **Medium**
 - certification S
 - market watch C
 - distribution S
 - vendor management C
 - business case evaluation S
- **Lower**
 - administering COTS licenses C

**S - spikes around
refresh cycle
anchor points**

C - continuous



COCOTS: Maintenance Phase Straw Model

CBS Maintenance Effort (for a Given Cycle Time T_M)

= *COCOMO Application Maintenance + COTS*

Reassessment + COTS Retailoring + COTS Glue Code

Evolution + COTS Volatility Effect on Application Effort

+ COTS Replacement

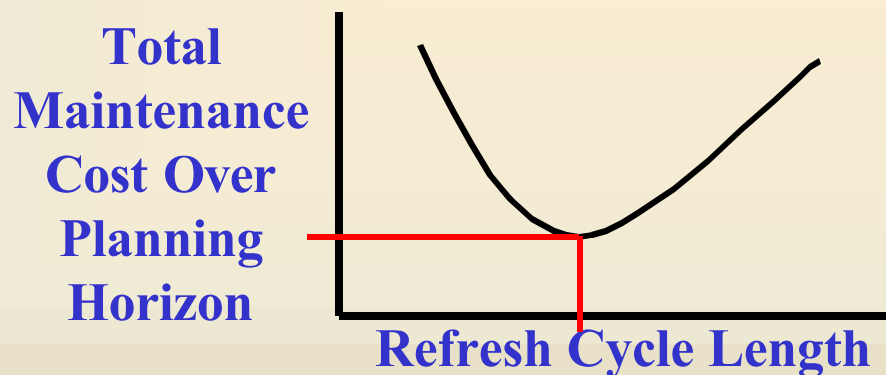
$$\text{CBS PM}_{\text{Maint Total}} = \sum_{\text{Over all } T_M} (\text{PM}_{\text{Maint-APP}} + \text{PM}_{\text{Re-ASST}} + \text{PM}_{\text{Re-TAIL}} + \text{PM}_{\text{GLUE-Evol}} + \text{PM}_{\text{VolEff-APP}} + \text{PM}_{\text{COTS-R}})$$



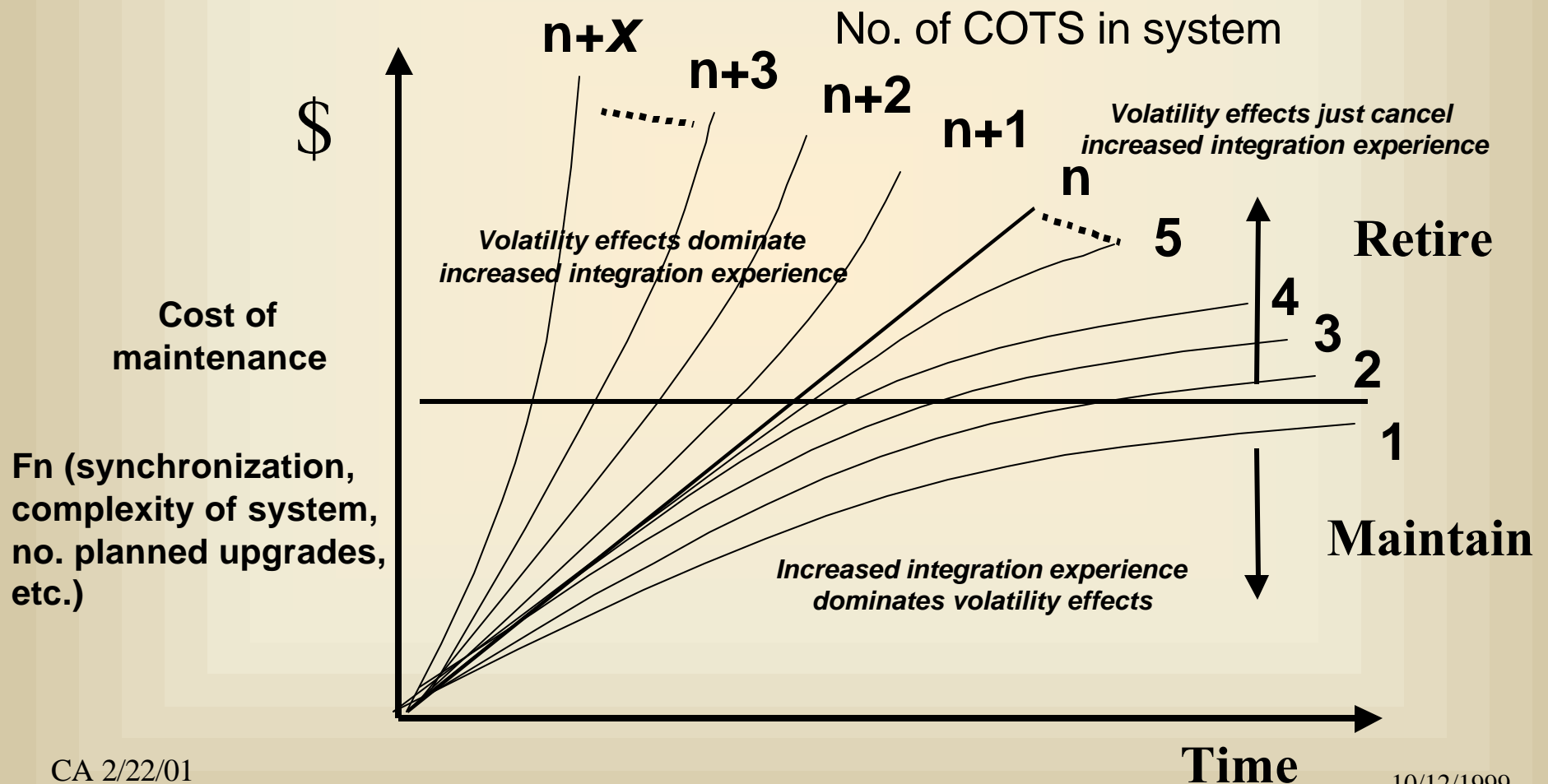
COCOTS: Maintenance Phase Straw Model

Determining Optimal Refresh Cycle Time T_M

- Allow estimation parameters to change between each cycle T_M
- Test several T_M cycle lengths over your total planning horizon
 - i.e., 9 months, 12 months, 18 months, 24 months, 36 months, etc.
- Select cycle length of least overall cost to schedule refresh efforts



A CBS Economic Lifespan Model: The COTS-LIMO Model





COCOTS Benefits

- **Existing**
 - Independent source of estimates
 - Checklist for effort sources
 - (Fairly) easy-to-use development phase tool

- **On the Horizon**
 - Empirically supported, tightly calibrated, total lifecycle COTS estimation tool