GOVERNMENT TAILORED COCOMO (GTCOCOMO)

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GOVERNMENT TAILORED COCONO (GTCOCONO)

BY

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OBJECTIVES:

- ACCOMPLISH INDEPENDENT, OBJECTIVE ASSESSMENT OF COMMAND SOFTWARE ENGINEERING CENTER RESOURCE REQUIREMENTS.

- METHODOLOGY/APPLIED DEVELOPED FOR STUDY SHOULD BE GENERALLY USABLE FOR OTHER DoD SOFTWARE REQUIREMENTS ASSESSMENTS

- PROJECT ANY ORGANIZATION'S SOFTWARE REQUIREMENTS

- BASELINE COST ESTIMATING TOOL FOR SOFTWARE

- PROGRAM MANAGEMENT SYSTEM TOOL FOR TIME PHASING OF SOFTWARE WITH HARDWARE REQUIREMENTS.
SOFTWARE/HARDWARE PHASE COMBINATIONS MODELED

1. SW DEVELOPMENT DURING HW R&D PHASE

2. SW DEVELOPMENT DURING HW PROD PHASE

3. SW MAINTENANCE DURING HW PROD PHASE WHEN ED MODELS ARE FIELDED
   OR INTERIM CONTRACTOR SW MAINTENANCE DURING HW DEPLOYMENT

4. SW MAINTENANCE DURING HW DEPLOYMENT PHASE
FIGURE 5-1  Software project phases, activities, and milestones
FIGURE 5-1 Software project phases, activities, and milestones
OUTPUTS OF GOVERNMENT TAILORED COCOMO (GTCOCOMO)

- An organization's manpower and associated cost requirements for software
- Effort estimated for each fiscal year
- Effort categorized by funding type (R&D, CMA & Other) and by personnel type (In-House & Contractor)
- The timing and effort requirements of an organization for each software development/maintenance subphase
- A listing of all inputs used
GTCOCOMC MODEL OUTPUT OF REQUIREMENTS BY FISCAL YEAR

<table>
<thead>
<tr>
<th>FUNDING TYPE &amp; PERSONNEL TYPE</th>
<th>FISCAL YEAR</th>
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</thead>
<tbody>
<tr>
<td>IN-HOUSE R&amp;D EFFORT</td>
<td>FY85 FY86</td>
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<tr>
<td>CONTRACTOR R&amp;D EFFORT</td>
<td></td>
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<tr>
<td>R&amp;D EFFORT SUBTOTALS</td>
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<tr>
<td>IN-HOUSE OMA EFFORT</td>
<td>NUMBER OF MANY YEARS</td>
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<tr>
<td>CONTRACTOR OMA EFFORT</td>
<td>AND COSTS PROJECTED FOR EACH EFFORT TYPE</td>
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<tr>
<td>OMA EFFORT SUBTOTALS</td>
<td>FOR EACH FISCAL YEAR</td>
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<tr>
<td>IN-HOUSE OTHER EFFORT</td>
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<tr>
<td>CONTRACTOR OTHER EFFORT</td>
<td></td>
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<tr>
<td>OTHER EFFORT SUBTOTALS</td>
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<tr>
<td>TOTAL EFFORT</td>
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DELSO Form 05A, (1 Apr 78)
<table>
<thead>
<tr>
<th>SOFTWARE SUBPHASES IN DEVELOPMENT</th>
<th>START DATE</th>
<th>END DATE</th>
<th>DURATION (MONTHS)</th>
<th>MANMONTHS OF EFFORT</th>
<th>NUMBER OF PEOPLE REQUIRED</th>
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<tr>
<td>PLANNING &amp; REQUIREMENTS</td>
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<td>PRELIMINARY DESIGN</td>
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<td>PROGRAMMING</td>
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<td>DETAILED DESIGN</td>
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<td>CODE &amp; UNIT TEST</td>
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<tr>
<td>INTEGRATION &amp; TEST</td>
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<tr>
<td>SOFTWARE SUBPHASES IN MAINTENANCE</td>
<td>START DATE</td>
<td>END DATE</td>
<td>DURATION (MONTHS)</td>
<td>MANMONTHS OF EFFORT</td>
<td>NUMBER OF PEOPLE REQUIRED</td>
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<tr>
<td>PROJECT TRAINING</td>
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<td>YEAR 1 OF SW MAINT</td>
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<td>YEAR 2 OF SW MAINT</td>
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<tr>
<td>FINAL YEAR OF SW MAINT</td>
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GOVERNMENT TAILORED COCOMO (GTCOCOMO) GENERALIZED EQUATIONS

AVERAGE DEVELOPMENT EFFORT:

\[
\text{ORG EFF}_\text{DEV} = \text{ORG POE}_\text{DEV} \times \text{EAM}_\text{DEV} \times K \times (KDSI + \text{ADSI} \times \text{AAF})^{\text{EXP}} \div \text{DUR}_\text{DEV}
\]

AVERAGE MAINTENANCE EFFORT:

\[
\text{ORG EFF}_\text{INT} = \text{ORG POE}_\text{INT} \times \text{EAM}_\text{INT} \times \text{ACT} \times 1.09 \times K \times (KDSI + \text{ADSI})^{\text{EXP}} \div 12
\]

\[\text{ORG EFF} - \text{ORGANIZATION'S EFFORT IN MANY YEARS}\]
\[\text{ORG POE} - \text{ORGANIZATION'S PERCENT OF EFFORT (WEIGHTED AVERAGE OF ACTIVITY POEs)}\]
\[\text{EAM} - \text{EFFORT ATTRIBUTE MULTIPLIER (PRODUCT OF INDIVIDUAL EAMs)}\]
\[K - \text{CONSTANT (EMBEDDED) - 2.8, SEMIDETACHED - 3.0, ORGANIC - 3.2)}\]
\[\text{KDSI} - \text{THOUSANDS OF DELIVERED SOURCE INSTRUCTIONS OF NEW PROGRAM}\]
\[\text{ADSI} - \text{THOUSANDS OF DELIVERED SOURCE INSTRUCTIONS OF ADAPTED/CONVERTED PROGRAM}\]
\[\text{AAF} - \text{ADAPTATION/CONVERSION ADJUSTMENT FACTOR (PERCENTAGE)}\]
\[\text{EXP} - \text{EXPONENT (EMBEDDED) - 1.20, SEMIDETACHED - 1.12, ORGANIC - 1.05)}\]
\[\text{DUR} - \text{DURATION OF SOFTWARE DEVELOPMENT EFFORT (MONTHS)}\]
\[\text{ACT} - \text{ANNUAL CHANGE TRAFFIC (PERCENTAGE OF TOTAL DSI MODIFIED PER YEAR)}\]
LIST OF COCOMO TABLES VALUES EMBEDDED IN GTCOCOMO

- Effort Attribute Multipliers for Software Development by Subphase (Tables 23-2 & 23-3)
- Effort Attribute Multipliers for Software Maintenance (Tables 8-2, 30-1 & 30-2)
- Requirements Volatility Effort Multiplier for Software Development (Table 23-2)
- Programming Language Effort Multiplier (Figure 28-2)
- Schedule Distribution by Node, Development Subphase, and Size (Table 6-8)
- Effort Distribution by Node, Development Subphase, and Size (Table 6-8)
- Project Activity Distribution by Node, Activity, Phases, and Size (Tables 7-1, 7-2 & 7-3)
- Constant and Exponential Values for Effort and Schedule Computations by Node (Table 9-1)
<table>
<thead>
<tr>
<th>SOFTWARE ACTIVITIES MODELED IN COCOMO</th>
<th>SW DEV</th>
<th>SW MAINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SW REQUIREMENT ANALYSIS</td>
<td>10%</td>
<td>50%</td>
</tr>
<tr>
<td>2. SW PRODUCT DESIGN</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>3. PROGRAMMING</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>4. SW TEST PLANNING</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>5. SW VERIFICATION AND VALIDATION</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>6. SW PROJECT OFFICE FUNCTIONS</td>
<td>10%</td>
<td>50%</td>
</tr>
<tr>
<td>7. SW CONFIGURATION MANAGEMENT AND QUALITY ASSURANCE</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>8. SW MANUALS</td>
<td>5%</td>
<td>100%</td>
</tr>
</tbody>
</table>
PERCENT OF EFFORT INPUT TO TAILORED COCOMO

- NOT CONSULTING, MONITORING, ANALYZING OR PERFORMING THE ACTIVITY - 0%

- CONSULTING OR MONITORING THE ACTIVITY - 5%

- MONITOR CONTRACT AND ANALYZE/REVIEW ACTIVITY PRODUCTS PRIOR TO APPROVAL - 10%

- VERIFICATION AND VALIDATION ACTIVITY (FOR CONVENTIONAL V & V) - 100%?

- PERFORMING THE TOTAL ACTIVITY - 100%
FIGURE 24-5 Spectrum of V&V levels

FIGURE 24-6 Sample V&V case-activity allocation
GENERALIZED INPUTS OF GOVERNMENT TAILORED COCOMO (GTCOCOMO)

- System Name and Software (SW) Node
- Indicator of Software/Hardware Phase Combinations Applied
- Starting and Ending Dates of Each Phase Combination
- Funding Type Applied to Each Phase Combination
  (Or Each SW Activity for Each Phase)
- Attribute Effort Multiplier Ratings
- Percent of Effort (POE) Applied to Each SW Activity for Each Phase Combination
- In-House Government Percent of Effort (GPOE) Associated to Each POE Input
- Additional Government Effort (percent Level of Effort for Non-System Specific
  Government Effort and Own Contractor Monitoring)
- Cost of Government and Contractor Personnel and Inflation Multipliers
GENERALIZED INPUTS OF GTCOCONO (CONTINUED)

FOR EACH SOFTWARE DEVELOPMENT PHASE:

- TOTAL NUMBER OF NEWLY DEVELOPED DELIVERED SOURCE INSTRUCTIONS (KDSI)
- TOTAL NUMBER OF ADAPTED DELIVERED SOURCE INSTRUCTIONS (ADSI)
  AND ADAPTATION ADJUSTMENT FACTOR (AAF)
- TOTAL NUMBER OF SEPARATE, INDEPENDENT EFFORTS
- IF KNOWN: KDSI, ADSI, AAF AND PROGRAM LANGUAGE OF EACH EFFORT
GENERALIZED INPUTS OF GTCOCOMO (CONTINUED)

FOR EACH SOFTWARE MAINTENANCE PHASE:

- TOTAL NUMBER OF MAINTAINED DELIVERED SOURCE INSTRUCTIONS (KDSI)
- TOTAL NUMBER OF SEPARATE, INDEPENDENT EFFORTS
- IF KNOWN: KDSI AND PROGRAM LANGUAGE OF EACH EFFORT
- ANNUAL CHANGE TRAFFIC AND YEARLY MULTIPLIERS
- PROJECT TRAINING PERCENTAGES (OF TOTAL SW DEVELOPMENT AND ASSOCIATED POE & GPOE)
- SW DEVELOPMENT SUBPHASE POE NOT ACCOMPLISHED APPEARING AS ADDITIONAL SW MAINTENANCE
ADDITIONAL EFFORT INPUTS:

- LEVEL OF EFFORT FOR NON-SYSTEM SPECIFIC EFFORT*
  - TOP MANAGEMENT - 2%
  - NON-SYSTEM SPECIFIC EFFORT OF SUPERVISORS - 5%
  - RESOURCE NGMT AND ADMIN SERVICES - 8%
  - CLERICAL AND OTHER SW RELATED PRODUCTS AND ACTIVITIES - 5%
  - COMPUTER SUPPORT SERVICES - 4%
  - TECHNICAL ADMIN AND MONITORING OF ETSSC CONTRACTORS - 10%
  - PROJECT TRAINING PRIOR TO FIELDING - 6%

*COST ONLY AT THIS TIME
GTCOCOMO INTERNAL COMPUTATION FEATURES

- PRODUCT OF EFFORT ATTRIBUTE MULTIPLIERS FOR EACH RUN
- DURATION OF SOFTWARE PHASES FOR EACH SW/HW PHASE COMBINATION APPLIED
- INDICATOR OF WHETHER SOFTWARE PHASES ARE WITHIN THE FISCAL YEARS SPECIFIED
- EFFORT AVERAGING WHEN DETAILS TO SEPARATE, INDIVIDUAL EFFORTS ARE UNKNOWN
- SCHEDULE EFFORT ATTRIBUTE MULTIPLIER BASED ON HARDWARE DEVELOPMENT SCHEDULE
- REVISED SOFTWARE DEVELOPMENT DATES BASED ON COCOMO MINIMUM SCHEDULE WHEN INPUTTED SCHEDULE IS UNREALISTIC
- STARTING AND ENDING DATES FOR EACH SOFTWARE SUBPHASE
GTCOCOMO INTERNAL COMPUTATION FEATURES (CONTINUED)

- MANHOURS OF EFFORT BY SOFTWARE SUBPHASES
- DEVELOPMENT MANPOWER REQUIRED BY SOFTWARE SUBPHASES BASED ON INPUTTED SCHEDULE
- MAINTENANCE MANPOWER REQUIRED FOR EACH YEAR AND PROJECT TRAINING PRIOR TO DEPLOYMENT
- GOVERNMENT AND CONTRACTOR MANPOWER REQUIRED BY FISCAL YEAR, PERSONNEL AND FUNDING TYPES
- DOLLAR REQUIREMENTS BY FISCAL YEAR, PERSONNEL AND FUNDING TYPES
- TOTAL MANPOWER REQUIREMENTS BY FISCAL YEAR OR SOFTWARE SUBPHASE