COSYSMO Working Group Meeting

outbrief

Ricardo Valerdi

USC Center for Software Engineering & The Aerospace Corporation
Workshop Goals

1. Present calibration results
2. Size driver counting rules exercise
3. Mini Delphi for EIA 632 activity distributions
4. Joint meeting with COSOSIMO workshop
5. COSYSIMO Risk/Confidence Estimation Prototype
6. COSYSIMO Future Vision
Participants (21)

John Rieff, Raytheon*
Anthony Peterson, Raytheon
George Stratton, Raytheon
Chris Miller, SPC
Steven Wong, Northrop Grumman*
Garry Roedler, LMCO*
Gary Hafen, LMCO
John Gaffney, LMCO
Evin Stump, Galorath
David Seaver, PRICE Systems
Dan Ligett, Softstar
Merrill Palmer, BAE Systems*
Jim Cain, BAE Systems*
Elizabeth O’Donnell, Boeing
John Salgado, Boeing
Paul Frenz, General Dynamics*
Paul Maggitti, General Dynamics*
Fran Marzotto, General Dynamics*
Ali Nikolai, SAIC*
Marilee Wheaton, Aerospace
Brad Clark, Software Metrics

*also provided COSYSMO data
## COSYSMO Data Sources

<table>
<thead>
<tr>
<th>Company</th>
<th>Services/Departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raytheon</td>
<td><em>Intelligence &amp; Information Systems (Garland, TX)</em></td>
</tr>
<tr>
<td>Northrop Grumman</td>
<td><em>Mission Systems (Redondo Beach, CA)</em></td>
</tr>
<tr>
<td>Lockheed Martin</td>
<td><em>Transportation &amp; Security Solutions (Rockville, MD)</em></td>
</tr>
<tr>
<td></td>
<td><em>Integrated Systems &amp; Solutions (Valley Forge, PA)</em></td>
</tr>
<tr>
<td></td>
<td><em>Systems Integration (Owego, NY)</em></td>
</tr>
<tr>
<td></td>
<td><em>Aeronautics (Marietta, GA)</em></td>
</tr>
<tr>
<td></td>
<td><em>Maritime Systems &amp; Sensors (Manassas, VA)</em></td>
</tr>
<tr>
<td>General Dynamics</td>
<td><em>Maritime Digital Systems/AIS (Pittsfield, MA)</em></td>
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<tr>
<td></td>
<td><em>Surveillance &amp; Reconnaissance Systems/AIS (Bloomington, MN)</em></td>
</tr>
<tr>
<td>BAE Systems</td>
<td><em>National Security Solutions/ISS (San Diego, CA)</em></td>
</tr>
<tr>
<td></td>
<td><em>Information &amp; Electronic Warfare Systems (Nashua, NH)</em></td>
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<tr>
<td>SAIC</td>
<td><em>Army Transformation (Orlando, FL)</em></td>
</tr>
<tr>
<td></td>
<td><em>Integrated Data Solutions &amp; Analysis (McLean, VA)</em></td>
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</tbody>
</table>
COSYSMO 1.0 Calibration Data Set

- Collected **35** data points
- From **6** companies; **13** business units
- No single company had > **30%** influence
Data Champions

- Gary Thomas, Raytheon
- Steven Wong, Northrop Grumman
- Garry Roedler, LMCO
- Paul Frenz, General Dynamics
- Sheri Molineaux, General Dynamics
- Fran Marzotto, General Dynamics
- John Rieff, Raytheon
- Jim Cain, BAE Systems
- Merrill Palmer, BAE Systems
- Bill Dobbs, BAE Systems
- Donovan Dockery, BAE Systems
- Mark Brennan, BAE Systems
- Ali Nikolai, SAIC
Size Driver Counting Rules

- **Requirements**
  - Sea level is where the contractor can demonstrate to the customer they understand what they want

- **Interfaces**
  - Reused interfaces are counted as a single interface so long as they are identical

- **Algorithms**
  - Includes associated effort such as design, simulation, training, specification, V&V

- **Operational Scenarios**
  - In the absence of any other information, all systems have at least one implied Op Scn
  - Be careful not to double count with requirements
Counting Rules Example

Elaborate COSYSMO example for sky, kite, sea, and underwater levels where:

Sky level: Build an SE cost model

Kite level: Adopt EIA 632 as the WBS and ISO 15288 as the life cycle standard

Sea level: Utilize size and cost drivers, definitions, and counting rules

Underwater level: Perform statistical analysis of data with software tools and implement model in Excel

Source: Cockburn 2001
## Effort Distribution Across EIA 632 Fundamental Processes

### N = 18

<table>
<thead>
<tr>
<th>EIA 632 Fundamental Process</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition &amp; Supply</td>
<td>7%</td>
<td>3.5</td>
</tr>
<tr>
<td>Technical Management</td>
<td>17%</td>
<td>4.5</td>
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<tr>
<td>System Design</td>
<td>30%</td>
<td>6.1</td>
</tr>
<tr>
<td>Product Realization</td>
<td>15%</td>
<td>8.7</td>
</tr>
<tr>
<td>Technical Evaluation</td>
<td>31%</td>
<td>8.7</td>
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</tbody>
</table>

Total = 100%
Effort Distribution of EIA 632 Fundamental Processes Across ISO 15288 Phases

\[ N = 15 \]

<table>
<thead>
<tr>
<th>Process</th>
<th>Conceptualize</th>
<th>Develop</th>
<th>Operational Test &amp; Eval.</th>
<th>Transition to Operation</th>
<th>Operate, Maintain, or Enhance</th>
<th>Replace or Dismantle</th>
<th>(check sum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition and Supply</td>
<td>28 (12.3)</td>
<td>51 (18.6)</td>
<td>13 (11.3)</td>
<td>8 (5.0)</td>
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<td>100</td>
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<tr>
<td>Technical Management</td>
<td>22 (10.0)</td>
<td>38 (9.9)</td>
<td>25 (7.4)</td>
<td>15 (6.4)</td>
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<td></td>
<td>100</td>
</tr>
<tr>
<td>System Design</td>
<td>34 (12.4)</td>
<td>40 (19.4)</td>
<td>17 (9.6)</td>
<td>9 (6.2)</td>
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<td></td>
<td>100</td>
</tr>
<tr>
<td>Product Realization</td>
<td>13 (14.1)</td>
<td>30 (24.3)</td>
<td>32 (16.0)</td>
<td>25 (20.4)</td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Technical Evaluation</td>
<td>18 (11.4)</td>
<td>27 (11.0)</td>
<td>40 (17.7)</td>
<td>15 (8.5)</td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

In each cell: Average (Standard Deviation)
Next Working Group Meeting:
Week of July 18 at the PSM Workshop, Keystone, CO

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Websites
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