Early Identification of Systems Engineering-Related Risks

Barry Boehm, Dan Ingold
USC-CSSE
3 March 2010
Outline

- Evaluation of potential effectiveness measures
- Development of evaluation framework and tools
- Demonstration of SE Performance Risk Tool (SEPRT)
- Evaluation of the framework and tools
Revised Set of Measurement Methods

- NRC Pre-Milestone A & Early-Phase SysE top-20 checklist
- Air Force Probability of Program Success (PoPS) Framework
- INCOSE/LMCO/MIT Leading Indicators
- Stevens Leading Indicators (new; using SADB root causes)
- USC Anchor Point Feasibility Evidence progress
- UAH teaming theories
- NDIA/SEI capability/challenge criteria
- SISAIG Early Warning Indicators/ USC Macro Risk Tool
First-order EM evaluation process

• Examine revised list of candidate EMs
  – Use NRC SE checklist as concise starting point
  – Identify similar key elements of other EMs
  – 45x8 cross product of EMs and characteristics
• Evaluate EMs against identified criteria
  – Preliminary “quick-look” evaluation by USC
  – Evaluation by originators, where possible
  – Follow-up with independent evaluation by team
• Review coverage/commonality of elements
  – Incorporate suggested additions (now 51 items)
# EM Coverage Matrix (v1.1)

<table>
<thead>
<tr>
<th>SERC EM Task Coverage Matrix v1.1</th>
<th>Effectiveness measure:</th>
<th>INCOSE Systems Engineering Leading Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USC evaluation scale:</strong></td>
<td><strong>Originator’s evaluation scale:</strong></td>
<td><strong>Your evaluation scale:</strong></td>
</tr>
<tr>
<td>x = covered by EM</td>
<td>5 = Fully addressed</td>
<td>0 = Not addressed</td>
</tr>
<tr>
<td>(x) = partially covered (unless stated otherwise)</td>
<td>4 = Adequately addressed</td>
<td>1 = Weakly addressed</td>
</tr>
<tr>
<td></td>
<td>3 = Mostly addressed</td>
<td>2 = Mostly addressed</td>
</tr>
<tr>
<td></td>
<td>2 = Somewhat addressed</td>
<td>3 = Strongly addressed</td>
</tr>
<tr>
<td></td>
<td>1 = Slightly addressed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 = Not addressed</td>
<td></td>
</tr>
</tbody>
</table>

**Effectiveness Measure Element**

<table>
<thead>
<tr>
<th>Effectiveness Measure Element</th>
<th>USC Evaluation</th>
<th>Originator’s Evaluation</th>
<th>Your Evaluation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concept Development</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least two alternatives have been evaluated</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can an initial capability be achieved within the time that the key program leaders are expected to remain engaged in their current jobs (normally less than 5 years or so after Milestone B)? If this is not possible for a complex major development program, can critical subsystems, or at least a key subset of them, be demonstrated within that time frame?</td>
<td>(x)</td>
<td>2-3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will risky new technology mature before B? Is there a risk mitigation plan?</td>
<td>x</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have external interface complexities been identified and minimized? Is there a plan to mitigate their risks?</td>
<td>x</td>
<td>5</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Outline

- Evaluation of potential effectiveness measures
- Development of evaluation framework and tools
- Demonstration of SE Performance Risk Tool (SEPRT)
- Evaluation of the framework and tools
Three SE Evaluation Frameworks

• SE performance assessment tool (SEPAT)
  – Evidence- and judgment-based
  – Discrete evaluation (typically at milestones)

• SE competency assessment tool (SECAT)
  – Knowledge, skills & abilities (KSA) inventories
  – Discrete evaluation

• SE leading indicators (INCOSE/LAI)
  – Quantitative, based on performance data
  – Continuous evaluation
SE Performance Assessment Tool

• Organizes EMs according to taxonomy like SISAIG 5x5 matrix
  – Group EM elements around high-level criteria ("goals")
  – Identify sub-criteria within each goal ("critical success factors")
  – Design questions that help decide if criteria are being met

• Provides tool PMs, PEOs can use for periodic evaluations
  – Decide importance (impact) of each question for project
  – Select degree of evidence that supports evaluation question
  – Lack of evidence, poor evidence suggests higher risk

• Evaluates risk exposure for given responses
  – Impact x Risk = Risk Exposure
  – Dashboard (red, yellow, green) for indicator of trouble spots
## SEPAT Taxonomy

<table>
<thead>
<tr>
<th>High-level Goals</th>
<th>Critical Success Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurrent definition of system requirements &amp;</td>
<td>Understanding of stakeholder needs</td>
</tr>
<tr>
<td>solutions</td>
<td>Concurrent exploration of solutions</td>
</tr>
<tr>
<td></td>
<td>System scoping &amp; requirements definition</td>
</tr>
<tr>
<td></td>
<td>Prioritization/allocation of requirements</td>
</tr>
<tr>
<td>System life-cycle organization, planning &amp; staffing</td>
<td>Establishment of stakeholder RAAs</td>
</tr>
<tr>
<td></td>
<td>Establishment of IPT RAAs</td>
</tr>
<tr>
<td></td>
<td>Establishment of resources to meet objectives</td>
</tr>
<tr>
<td></td>
<td>Establishment of selection/contracting/incentives</td>
</tr>
<tr>
<td></td>
<td>Assurance of necessary personnel competencies</td>
</tr>
<tr>
<td>Technology maturing &amp; architecting</td>
<td>COTS/NDI evaluation, selection, validation</td>
</tr>
<tr>
<td></td>
<td>Life-cycle architecture definition &amp; validation</td>
</tr>
<tr>
<td></td>
<td>Use of prototypes, models, etc. to validate maturity</td>
</tr>
<tr>
<td></td>
<td>Validated budgets &amp; schedules</td>
</tr>
<tr>
<td>Evidence-based progress monitoring &amp; commitment</td>
<td>Monitoring of system definition</td>
</tr>
<tr>
<td>reviews</td>
<td>Monitoring of feasibility evidence development</td>
</tr>
<tr>
<td></td>
<td>Monitoring/assessment/replanning for changes</td>
</tr>
<tr>
<td></td>
<td>Identification and mitigation for feasibility risks</td>
</tr>
<tr>
<td></td>
<td>Reviews to ensure stakeholder commitment</td>
</tr>
</tbody>
</table>
Candidate SE Competency Framework

• Developed by ODNI
• Comprehensive survey of core competencies
  – 10 candidate work activities
  – 173 candidate knowledge, skills & abilities (KSAs)
• To our knowledge, not yet validated
• Approved for limited release within SERC
# ODNI SE Competency Survey Example

## KSAs - #s 1-11 of 173

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Skill in preparing technical documents which define, specify, and recommend system characteristics.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Skill in initiating specifications, drawings, and other technical instructions supporting system acquisition and technical baselining.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Skill in developing resource estimates (e.g., cost, equipment, software, people).</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Skill in contributing to the development of program budgets.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Skill in addressing the scope of the technical effort required to develop the system.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Skill in developing a Systems Engineering Plan/Systems Engineering Management Plan (SEP/SEMP) that describes the program’s systems engineering processes, resources, metrics, and technical review process.</td>
<td></td>
</tr>
</tbody>
</table>

## Importance Scale for KSAs

<table>
<thead>
<tr>
<th>Importance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NR = Not relevant to job.</td>
<td></td>
</tr>
<tr>
<td>1 = Minor importance for effective performance</td>
<td></td>
</tr>
<tr>
<td>2 = Some importance for effective performance</td>
<td></td>
</tr>
<tr>
<td>3 = Important for effective performance</td>
<td></td>
</tr>
<tr>
<td>4 = Very important for effective performance</td>
<td></td>
</tr>
<tr>
<td>5 = Extremely important for effective performance</td>
<td></td>
</tr>
</tbody>
</table>
• Concept like EM discrete-event evaluation framework

• Organize competencies against candidate framework
  – Group SE work activities/ KSAs around high-level criteria ("goals")
  – Identify sub-criteria within each goal ("critical success factors")
  – Choose questions that help decide if criteria are being met

• Scoring of importance dependent on project context
## SE Competencies Evaluation Framework

<table>
<thead>
<tr>
<th>Competencies</th>
<th>Work Activities / Knowledge, Skills and Abilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurrent definition of system requirements &amp; solutions</td>
<td>WAs: 1-3</td>
</tr>
<tr>
<td></td>
<td>KSAs: 1-3, 5, 11, 12, 22, 23, 29, 30, 34-43, 46, 54, 61, 62, 73-76, 83-85, 92, 96, 100, 149</td>
</tr>
<tr>
<td>System life-cycle organization, planning &amp; staffing</td>
<td>WAs: 9, 10</td>
</tr>
<tr>
<td></td>
<td>KSAs:44, 45, 77-81, 98</td>
</tr>
<tr>
<td>Technology maturing &amp; architecting</td>
<td>WAs: 7, 8</td>
</tr>
<tr>
<td></td>
<td>KSAs:15-18, 20, 21, 24, 26, 28, 31, 32, 47, 48, 51, 55, 82, 83, 86-91, 93-95, 97, 98, 103-110, 113, 122, 124, 135, 136, 148, 159</td>
</tr>
<tr>
<td>Evidence-based progress monitoring &amp; commitment reviews</td>
<td>WAs: 4-10</td>
</tr>
<tr>
<td></td>
<td>KSAs: 3, 4, 6-10, 13, 14, 19, 25, 27, 33, 49, 52, 56, 57, 66, 71, 72, 101, 102, 112, 115, 123, 125-128, 132-134, 137-145, 153, 156-173</td>
</tr>
</tbody>
</table>
Continuous Evaluation Framework

- Ongoing evaluation, throughout program life-cycle
- Rely on information normally gathered in programs
- INCOSE/LAI/PSM/SEARI SE Leading Indicators Guide
  - Evaluate the goodness of systems engineering on a program
  - Draw on trend information to allow predictive analysis
  - Predict future performance before performance is realized
- Thirteen leading indicators already piloted and validated
- Detailed specifications of indicator, methods, attributes, etc.
- Additional leading indicators identified
- Present as management “dashboard”
Target EM Task Benefits

• Early warning vs. late discovery of SysE effectiveness problems
• Identification of current EM capability gaps
  – Recommendations for most cost-effective enhancements, research on new EM approaches
  – Ways to combine EM strengths, avoid weaknesses
• Foundation for continuous improvement of SysE effectiveness measurement
  – Knowledge base of evolving EM cost-effectiveness
  – Improved data for evaluating SysE ROI
Summary of SE EM Approach

• Consistent SE evaluation approach across multiple scales
  – Macro-level evaluates SE risk factors to program
  – Personnel-level evaluates SE competencies
  – Operational-level evaluates SE day-to-day performance & trends

• All levels permit forward-looking evaluation of SE risks
  – Macro- and personnel levels via Macro Risk-like tool
  – Operational level via data already gathered in typical programs
  – Tailorable to specific program domains & impacts of risks
Outline

- Evaluation of potential effectiveness measures
- Development of evaluation framework and tools
- Demonstration of SE Performance Risk Tool (SEPRT)
- Evaluation of the framework and tools
Systems Engineering Performance Risk Tool (SEPRT) Demonstration
Outline

• Evaluation of potential effectiveness measures
• Development of evaluation framework and tools
• Demonstration of SE Performance Risk Tool (SEPRT)
• Evaluation of the framework and tools
Pilot Evaluation Methodology

• Complete initial individual EM evaluations
  – Propose domains of use
  – Identify questions to determine evidence of performance
• Begin evaluation against Systemic Analysis Database (SADB)
  – Pose question, “Would this measure have identified problem?”
  – Focus domains of applicability for individual measures
• Pilot frameworks/tools in real project settings
  – Government contractors
  – Agency
  – Evaluate against case studies of historical successes/failures
Overview of Pilot Evaluations

• Tools piloted across five DoD projects, one NASA project
  – Applications include space, medical, logistics, systems of systems
• Found useful across all project phases, except Production
  – Most useful in SDD phase
  – More useful in early phases than later
  – “Early Phases” continue throughout evolutionary development
• Found at least somewhat effective in all but legacy systems
• Evaluation takes about 2-5 hours, easy to find material
  – For persons familiar with project
• Presently DoD-centric, non-specific to problem domain
• General impression was “too many findings”
Details of SEPAT Pilot Evaluation

• Particularly useful in SDD, somewhat useful earlier, less later
  – As expected, given sources of effectiveness measures
  – Expect higher leverage of SE in early phases
• Effectiveness from “very effective” to “somewhat effective”
  – Majority report “effective”
  – Only legacy project reported “ineffective”
• Clear that tailoring will be necessary
  – Project type: large new, small new, legacy, etc.
  – Terminology, even within DoD evaluations
  – Explore risks specific to problem domains
  – Supplement for later life-cycle phases (add testing, CM, etc.)
Details of SECAT Pilot Evaluation

- Most useful in SDD, earlier phases, less in later phases
- Split between “effective” and “somewhat effective”
- Again clear that further development & tailoring required
  - Questions not as well developed as SEPAT (not even questions)
  - Range of skills covered very broad
  - Issues of terminology, especially for non-DoD programs
  - Difficult for non-technical evaluator to judge competence
- “To be effective, must have some control over who assigned.”
Rating Scale Improvements

• Earlier workshop suggested red/yellow/green/\{gray,blue\} ratings in place of 1-5 scales to simplify assessment
• Also recommended red/yellow/green risk exposure ratings to provide traffic-light quick look at program status
• Several reviewers comment that R/Y/G RE makes the ratings too discrete – “if everything is critical, nothing is critical”
  – Increase RE scale to allow orange (between red-yellow) and light green (between yellow-green) results
  – Soften scales slightly: “no” impact/risk becomes “little-or-no”
  – Rephrase criticality scales, include probability, size of loss
  – Add count of CSF elements at highest risk level (i.e., Red-4 worse than Red-1)
• Is “external” validation required to get a green rating?
  – If true, entire program would need external validation for success to be considered likely
  – Emphasis on “independent,” which may need to be external

• What constitutes sufficient evidence?
  – Something objectively verifiable
  – May need definitions of strictness of required evidence

• Guidance on definitions for impact would help consistency
  – Specified in terms of lives, dollars, project value, etc.
  – May need to specify goal for each question to determine impact
• Pointers that direct to more detailed information
  – Expand awareness of issues that might be involved
  – Help avoid “blind spots” typical of similar programs
  – Example: areas that might be KPPs for systems in this domain

• Impact and evidence columns filled out independently
  – Also, perhaps hidden from each other to reduce “gaming”
Steps for Developing Feasibility Evidence

- Develop plans for developing work-products/artifacts
- Determine most critical feasibility assurance issues
  - Based on SEPAT, SECAT question impact/priority ratings
- Evaluate feasibility assessment options
  - Cost-effectiveness, rework avoidance, risk reduction ROI
  - Tool, data, mission scenario availability
- Select options, develop feasibility assessment plans
- Prepare evidence development plans and earned value milestones

“Steps” denoted by bullets rather than numbers to indicate that many are done concurrently
Steps for Developing Feasibility Evidence (cont.)

• Begin monitoring progress with respect to plans
  – Also monitor project/technology/objectives changes and adapt plans
• Prepare evidence-generation enablers
  – Assessment criteria
  – Parametric models, parameter values, bases of estimate
  – COTS assessment criteria and plans
  – Benchmarking candidates, test cases
  – Prototypes/simulations, evaluation plans, subjects, and scenarios
  – Instrumentation, data analysis capabilities
• Perform pilot assessments; evaluate and iterate plans and enablers
• Assess readiness for SEPAT-SECAT evidence assessment
  – Evidence shortfalls identified as risks and covered by risk mitigation plans
  – Proceed to Milestone Review if ready
• Hold Milestone Review when ready; adjust plans based on review outcomes
Future Directions

- Make tools easier to extend
  - Options: PHP, Access
- Develop initial domain extensions
  - In collaboration with early users
- Develop assessment summaries
  - Top risks; candidate mitigation options
- Develop non-DoD version
  - Possible NASA sponsor
- Develop, initially populate prototype Knowledge Base
- Coordinate with related efforts
  - INCOSE Leading Indicators; NDIA, other-DoD personnel competency initiatives, SERC Graduate SE Body of Knowledge and Reference Curriculum RT
Conclusions

• Tools show reasonable multi-phase, cross-domain utility
  – Improvements workable; some already worked
• Extensions to other domains, later phases beneficial
• Potential as method to bridge acquirer/contractor interaction
  – Common framework to structure, standardize discussion
  – Emphasis on objective evidence, independently verified
  – Add incentive by tying to portion of award fee
QUESTIONS...?
Backup Charts
## Goal 1:
System and software objectives and constraints have been adequately defined and validated.

### Critical Success Factor 1

<table>
<thead>
<tr>
<th>Question #</th>
<th>Impact (1-5)</th>
<th>EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>3 Unavailable</td>
<td></td>
</tr>
<tr>
<td>1(b)</td>
<td>3 Meager</td>
<td></td>
</tr>
<tr>
<td>1(c)</td>
<td>2 Fragmentary</td>
<td></td>
</tr>
</tbody>
</table>

System and software functionality and performance objectives have been defined and prioritized.
- Are the user needs clearly defined and tied to the mission?
- Is the impact of the system on the user understood?
- Have all the risks that the software-intensive acquisition will not meet the user expectations been addressed?

### Critical Success Factor 2

<table>
<thead>
<tr>
<th>Question #</th>
<th>Impact (1-5)</th>
<th>EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(a)</td>
<td>3 Unavailable</td>
<td></td>
</tr>
<tr>
<td>2(b)</td>
<td>4 Fragmentary</td>
<td></td>
</tr>
<tr>
<td>2(c)</td>
<td>5 Strong</td>
<td></td>
</tr>
</tbody>
</table>

The system boundary, operational environment, and system and software interface objectives have been defined.
- Are all types of interface and dependency covered?
- For each type, are all aspects covered?
- Are interfaces and dependencies well monitored and controlled?

### Critical Success Factor 3

<table>
<thead>
<tr>
<th>Question #</th>
<th>Impact (1-5)</th>
<th>EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(a)</td>
<td>5 Strong</td>
<td></td>
</tr>
</tbody>
</table>

System and software flexibility and resolvability objectives have been defined and prioritized.
- Has the system been conceived and described as "evolutionary"?
### Initial EM Coverage Matrix

#### SERC EM Task Coverage Matrix V1.0

<table>
<thead>
<tr>
<th>Concept Dev</th>
<th>NRC</th>
<th>Probability of Success</th>
<th>SE Leading Indicators</th>
<th>LIPSF (Stevens)</th>
<th>Anchoring SW Process (USC)</th>
<th>PSSES (U. of Alabama)</th>
<th>SSEE (CMU/SEI)</th>
<th>Macro Risk Model/Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atleast 2 alternatives have been evaluated</td>
<td>X</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x (w.r.t NPR)</td>
<td>(x)</td>
<td></td>
</tr>
<tr>
<td>Can an initial capability be achieved within the time that the key program leaders are expected to remain engaged in their current jobs (normally less than 5 years or so after Milestone B)? If this is not possible for a complex major development program, can critical subsystems, or at least a key subset of them, be demonstrated within that time frame?</td>
<td>x</td>
<td></td>
<td>(x)</td>
<td>x</td>
<td>x</td>
<td>(5 years is not explicitly stated)</td>
<td>(x)</td>
<td>(seems to be inferable from the conclusions)</td>
</tr>
<tr>
<td>Will risky new technology mature before B? Is there a risk mitigation plan?</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>(x)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Have external interface complexities been identified and minimized? Is there a plan to mitigate their risks?</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

#### KPP and CONOPS

<table>
<thead>
<tr>
<th>KPP and CONOPS</th>
<th>NRC</th>
<th>Probability of Success</th>
<th>SE Leading Indicators</th>
<th>LIPSF (Stevens)</th>
<th>Anchoring SW Process (USC)</th>
<th>PSSES (U. of Alabama)</th>
<th>SSEE (CMU/SEI)</th>
<th>Macro Risk Model/Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Milestone A, have the KPPs been identified in clear, comprehensive, concise terms that are understandable to the users of the system?</td>
<td>x</td>
<td></td>
<td>(x)</td>
<td>x</td>
<td>(x) (strongly implied)</td>
<td>(x) (implied)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>At Milestone B, are the major system-level requirements (including all KPPs) defined sufficiently to provide a stable basis for the development through IOC?</td>
<td>x</td>
<td></td>
<td>x</td>
<td>(x)</td>
<td>x</td>
<td>x</td>
<td>(x)</td>
<td>(There is no direct reference to this but is inferable)</td>
</tr>
<tr>
<td>Has a CONOPS been developed showing that the system can be operated to handle the expected throughput and meet response time requirements?</td>
<td>x</td>
<td></td>
<td>x</td>
<td>(x)</td>
<td>(x) (there is a mention of a physical solution. That's the closest in this regard)</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- X = covered by EM
- (x) = partially covered (unless stated otherwise)
EM Independent Evaluation

• Prepare evaluation matrix for each EM
  – Initial USC evaluation
  – Originator evaluation (where available)
  – Independent evaluator rating (0-3) and comments

• Compile results, iterate, try to reach consensus

• Expected results
  – Identify most effective EMs
  – Determine most relevant domain of use
  – Suggest evaluation questions for evidence-/judgment-based measures

• Now in process with independent evaluators
# Independent EM Evaluations and Resolution

<table>
<thead>
<tr>
<th>Candidate EM</th>
<th>USC</th>
<th>Stevens</th>
<th>FC-MD</th>
<th>UAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>PoPS Leading Indicators</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCOSE LIs</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stevens LIs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>SISAIG LIs/ Macro Risk</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>NRC Top-20 List</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
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<td>USC AP-Feasibility Evidence</td>
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<td>UAH Team Effectiveness</td>
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03/03/2010
<table>
<thead>
<tr>
<th>Effectiveness Measure</th>
<th>Number Covered</th>
<th>Percent Covered</th>
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<tbody>
<tr>
<td>SEI SSEE*</td>
<td>36</td>
<td>80%</td>
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<tr>
<td>INCOSE SE LI*</td>
<td>35</td>
<td>78%</td>
</tr>
<tr>
<td>NRC</td>
<td>30</td>
<td>67%</td>
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<tr>
<td>USC Anchor Point</td>
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<td>62%</td>
</tr>
<tr>
<td>SISAIG/Macro Risk</td>
<td>27</td>
<td>60%</td>
</tr>
<tr>
<td>UAH PSSES*</td>
<td>24</td>
<td>53%</td>
</tr>
<tr>
<td>Army PoPS</td>
<td>19</td>
<td>42%</td>
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<tr>
<td>Stevens LI-PSF*</td>
<td>18</td>
<td>40%</td>
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* Reviewed by originator
EM Commonality

Commonality of Individual SE Measures

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<thead>
<tr>
<th># of SEs Covering</th>
<th># of EM Elements Covered</th>
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# of Mentions   Effectiveness Measures

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<tr>
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