

Practical Software and Systems Measurement

Practical Software and Systems Measurement

A foundation for objective project management



***Systems Engineering Leading
Indicators***

24 June 2009

***Garry Roedler Howard Schimmoller
Cheryl Jones***

***PSM Users Group Conference
Orlando, Florida***

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Systems Engineering Leading Indicators Workshop

- ***SE Leading Indicators are measures that provide indications of the effectiveness of systems engineering***
- ***This workshop will:***
 - ***build on previous work in this area as part of the preparation of a revision of the SE Leading Indicators Guide***
 - ***review draft materials, including write-ups of candidate SE leading indicators and draft document update***
 - ***discuss other candidate indicators and analysis techniques***

Objectives of the Workshop

- ***Share background and latest results from academia/industry/ government collaboration on leading indicators for systems engineering programmatic and technical performance***
- ***Review and refine the following in preparation for a revision to the guide***
 - ***Proposed new indicators – drafts and concepts***
 - ***Modifications to the existing indicators***
 - ***Supporting guidance***
 - ***Analysis techniques***
 - ***Structure and format issues***
 - ***Lessons learned and feedback***
- ***This is not intended to be a tutorial of the set of indicators***

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Workshop Format

- ***Agenda***
 - ***Introduction and Objectives to Baseline New Participants***
 - ***Review of draft document update; reformatting and measurement matrix (Howard Schimmoller)***
 - ***Discussion of outstanding sections, not yet reviewed.***
 - ***Test Completeness (Mike Uchino)***
 - ***Algorithm & Scenario Trends (Gan Wang, Al Schernoff, and John Rieff)***
 - ***Architecture Trends (Bob Swarz, and John Rieff)***
 - ***Discussion of selected/updated sections already reviewed by the team in telecons (based on speaker availability and updated to status)***
 - ***Review of Complexity Change Trends (Sarah Sheard and Dave Henry)***
 - ***Review of Affordability Trends (Reggie Cole, John Gaffney, and Howard Schimmoller)***
 - ***Defect and Error Trends (John Gaffney, Dave Henry, Bob Welldon, Winsor Brown, Trendy LeForge, and Cheryl Jones)***
 - ***Includes Defects Escape Trends (Jerry Fisher)***
 - ***Presentation of additional potential measures***
 - ***Potential additions of NAVAIR Indicators (Greg Hein)***
 - ***Highlighting coordination efforts with complimentary industry efforts***
 - ***Review UERC Activities (Garry Roedler)***
 - ***Final Confirmation of New Indicators - Time Pending***
- ***Techniques that will be used***
 - ***Group interaction***
 - ***Review and discussion***

Workshop Background

- ***PSM history in this area***
 - ***Beta version of SE Leading Indicators Guide published in Dec 2005***
 - ***SE Leading Indicators Guide published in June 2007***
 - ***Collaboration between LAI, PSM, INCOSE and industry***
 - ***Workshops held at PSM UG Conference in July 2007/2008, GEIA Engineering and Technical Management Conference in Sep 2007***
 - ***SE Measurement Survey conducted by Don Reifer in June 2008***
 - ***Kick-off of revision effort on 20 Feb 2009 with expanded collaborative team***

Intended Output

- ***Revised versions of draft materials for SELI Guide***
- ***Consensus on the reviewed indicators and other changes***
- ***Plan for going forward***

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Practical Software and Systems Measurement Workshop Participants

- ***At workshop***

- ***Howard Schimmoller, LMC***
- ***Garry Roedler, LMC***
- ***Cheryl Jones, PSM, US Army***
- ***Barry Boehm, USC***
- ***Greg Hein, BAH-NAVAIR***
- ***Gan Wang, BAE Systems***
- ***Alex Shernoff, BAE Systems***
- ***Kevin Woodward, LMC***
- ***Ed Casey, Raytheon***
- ***Trindy LeForge, Raytheon***
- ***Dan Ingold, USC***
- ***Jared Fortune, USC***
- ***Rick Cline, Boeing***
- ***Greg Mazourek, LMC***
- ***Bill Golaz, LMC***
- ***Mike Ross, Tecolote***
- ***Victoria Shu, NAVAIR***

- ***By Phone***

- ***Sarah Sheard, INCOSE***
- ***Bob Swarz, Mitre***
- ***David Henry, LMC***
- ***Reggie Cole, LMC***
- ***John Gaffney, LMC***
- ***Ann Wildgen, LMC***
- ***Mike Ucchino, AFIT-CSE***
- ***Winsor Brown, USC***
- ***Beth O'Donnell, Boeing***
- ***Tom Bottegal, Aerospace***
- ***Vaughn R., LMC***

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Practical Software and Systems Measurement Summary

- ***Achieved most of the identified objectives for the workshop***
 - ***Reviewed & discussed draft indicators and/or concepts for indicators***
 - ***Test Completeness, Algorithm & Scenario Trends, Architecture Trends, and Complexity***
 - ***Deferred review of 2 indicators until next SELI telecon***
 - ***Reviewed & discussed indicator validation and correlation approach from NAVAIR***
 - ***Reviewed objectives and interactions from collaboration with SERC Effectiveness Measurement Project***

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Conclusions, Recommendations, and Results

- ***Test Completeness Indicator***
 - ***Looked at concepts and examples for Specifications Verified and KPPs Validated***
 - ***Examples do not appear to be “leading”***
 - ***Not clear that these will drive proactive decisions – addresses problems, not risks***
 - ***Discussed other concepts for test completeness***
 - ***Number of requirements mapped to (or addressed by) test cases (per plan) of total requirements for which test has been designated as the verification method***
 - ***Number of requirements with compliance issues versus the number of compliance issues resolved by each milestone***
 - ***Actions:***
 - ***Mike Ucchino to follow up with Tom Wissink on further development of this indicator***
 - ***Victoria Shu to provide NAVAIR POC to work with***

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Conclusions, Recommendations, and Results

- **Architecture Indicator**
 - **Looked at concepts and examples for Architecture maturity over time**
 - **Looks at maturing of the architecture by assessing the architecture effort and products against 8 factors on a 5-point rating scale for each factor**
 - **Scores for the factors are summed to provide total score**
 - **Need to look at minimum score of any factor in addition to total and average score**
 - **Scores should be increasing over time – or could indicate an emerging problem to investigate**
 - **Consider adding factor for skill of architecture team**
 - **Scale could be user defined and allow weighting**
 - **Consider adding how well you have elaborated use cases into sequence diagrams, etc.**
 - **Look at OSD architecture metrics from Technomics – may provide addition insight**
 - **Actions:**
 - **Greg Hein to provide copy of OSD architecture metrics from Technomics**
 - **Victoria Shu to provide copy of NAVAIR whitepaper on Architecture Assessment process**
 - **Victoria Shu to provide name of NAVAIR subject Matter expert**
 - **Bob Swarz and John Rieff to consider recommendations**

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Conclusions, Recommendations, and Results

- ***Algorithm and Scenario Trends Indicator***
 - ***Analyzed scope and content***
 - ***Does not appear to be independent of the other indicators, especially Architecture Trends***
 - ***Some correlation to Requirements trends***
 - ***Consider adding to Architecture indicator as two additional factors/base measures***
 - ***May need to rename the indicators***
 - ***May help provide insight into how we are managing the complexity of the architecture***
 - ***Should define relationship of Scenarios to the other things such as Use Cases***
 - ***Actions:***
 - ***Gan Wang to get together with Bob Swarz and John Rieff on further investigate merging this indicator into the Architecture indicator***

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Conclusions, Recommendations, and Results

- **Complexity Indicator**
 - **Need to ensure common understanding of general concepts regarding what complexity is**
 - **Concepts seem to be intuitive**
 - **Consider the following 2 facets for each of the types/factors of complexity**
 - **Where it is currently**
 - **How well the org/program is poised to manage it**
 - **Need to ensure clarity about what this is a leading indicator for (i.e., how does a program manager use it?)**
 - **Could be that it tells the PM whether the program is in a position to address/manage the risks**
 - **Are there other risk that needed to be addressed?**
 - **Provide guidance on using this indicator for insight into potential downstream concerns**
 - **Increase in complexity is an indicator of potential/probable changes to other indicators, such as requirements**
 - **Changes in each factor of complexity (e.g., Static – Size) has specific downstream relationships that are affected by changes in complexity for that factor**
 - **Other Considerations:**
 - **Need to consider the cross-cutting KPPs**
 - **Complexity also indicates a level of uncertainty that relates to risk**
 - **Should it look below the system level also?**
 - **Actions:**
 - **Sarah Sheard and Dave Henry to consider these recommendations**

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NAVAIR Applied Leading Indicators (ALI) Methodology

- ***Methodology looks at multiple data for a specific information need and systematically analyzes the data to determine mathematically valid relationships with significant correlation***
 - ***These are then identified as Applied Leading indicators***
- ***The methodology meets the intent of the SELI effort, providing a structure approach for validation of the LIs***
- ***Unanimous agreement to include this in the SELI guide***
- ***Actions:***
 - ***Greg Hein to summarize the methodology for incorporation into the SELI Guide revision as an appendix***
 - ***Summary will include links to any supplementary information and guidance***

Practical Software and Systems Measurement Interaction with SERC SE Effectiveness Measurement Project

- ***SE Leading Indicators Guide is pointed to from SERC SE Effectiveness Measurement (EM) project for quantitative measurement perspective***
- ***SERC EM contribution:***
 - ***Short-term:***
 - ***Mapping of SE Effectiveness Measurement Framework to SE Leading Indicators (SELI)***
 - ***51 Criteria => Critical Success Factors => Questions => SELI***
 - ***Critical Success Factors serve as Information Needs***
 - ***Questions serve as Measurable Concepts***
 - ***Mapping of 51 Criteria to SELI***
 - ***Review to ensure consistency of concepts and terminology***
 - ***Longer-term:***
 - ***Work with OSD to get infrastructure in place to support data collection and analysis***
 - ***Tie to SRCA DB (TBR)***
 - ***May require government access and analysis***
 - ***Actions:***
 - ***Dan Ingold to coordinate with Garry Roedler and Howard Schimmoller, then provide the mappings described above under Short-term items***

Next Steps/Action Items

- ***Continue to conduct SELI telecons every 3 weeks***
 - ***Contact Howard Schimmoller, Gary Roedler, or Cheryl Jones for information***
- ***Release revision to SELI Guide revision in Oct/Nov timeframe***