



20th Practical Software and Systems Measurement Users' Group Meeting and Workshops

“Aligning Measurement with System Life Cycle Realities”

**September 16-20, 2019
Arlington, Virginia**

Meeting and Workshops Agenda

Time	Monday	Tuesday	Wednesday ¹	Thursday	Friday
7:30 – 8:30	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast	Continental Breakfast
Morning Session* 8:30 – 12:30	PSM Training	Welcome & Introductions; Keynotes; Presentations	Keynote, Presentations	Presentations	Workshop Outbriefs Wrap-up
Lunch 12:30 – 1:30	Lunch	Lunch	Lunch	Lunch	
Afternoon Session* 1:30 – 5:00	PSM Training	Concurrent Workshops 1-3	Concurrent Workshops 4-6	Concurrent Workshops 7-9	

* Morning and afternoon breaks included

Other Agenda Items and Schedule

Monday, 16 September 2019

7:30am - 8:30am On-Site Conference Registration

8:30am – 5:00pm **PSM Training:** This course is an introduction to PSM for those who are new to PSM or who want a refresher course on the PSM principles and information-driven measurement process. The new DAU lesson on agile measurement will also be presented as part of this training course.

Tuesday, 17 September 2019

7:30am - 8:30am On-Site Conference Registration

Wednesday, 18 September 2019

10:40am PSM Group Picture

5:00pm PSM Dinner: Ted's Montana Grill

Friday, 20 September 2019

10:00am - 12:00pm Workshop Outbriefs
Each workshop lead will summarize the results of their workshop and discuss future goals.

12:00am - 12:20pm Conference Wrap-Up

¹ Group picture Wednesday AM - location will be announced.

Presentations: Tuesday - Friday

Presentation Abstracts are provided starting on page 14

Time	Tuesday	Wednesday	Thursday	Friday
8:30 - 8:40	<i>Welcome and Announcements</i>	<i>Announcements</i>	<i>Announcements</i>	<i>Announcements</i>
8:40 - 9:20	<p><i>(0840-0900) Introductions</i></p> <p><i>(0900-0950) Keynote: Defense Innovation Board (DIB) Measures – OUSD A&S Implementation</i></p> <p><i>Dr. Jeff Boleng</i></p>	<p><i>New Army Software Sustainment Cost Estimating Results</i></p> <p><i>Cheryl Jones, James Doswell</i></p>	<p><i>Panel: Agile Estimation with Simple Function Points</i></p> <p><i>David Seaver, Lyle Patashnick, Katie Noreiga, Paul Cymerman</i></p>	<p><i>Struggles at the Frontiers of Systems Engineering and Measurement: Special Focus - Aligning Measurement with System Life Cycle Realities</i></p> <p><i>Kenneth E. Nidiffer</i></p>
0920 - 1000	<p><i>(0950-1000) Technical Measurement Working Group: MOEs, KPPs, MOPs, and TPMs</i></p> <p><i>Garry Roedler, Cheryl Jones</i></p>	<p><i>The Application of Nonlinear Regression Methods to Army Software Maintenance Cost Estimation</i></p> <p><i>Dr. Christian Smart, Kimberly Roye</i></p>	<p><i>Do Software Architecture Patterns Reduce Security Vulnerabilities? Insight from Causal Learning</i></p> <p><i>Robert Stoddard, Dr. Rick Kazman, Dr. Mike Konrad, Dr. William Nichols</i></p>	<p><i>Agile Measurement within the Armament SEC</i></p> <p><i>Chris Costello</i></p>
10:00 - 10:40	<p><i>A Path Toward Consensus Measures for Iterative Software Development</i></p> <p><i>Geoff Draper, Cheryl Jones</i></p>	<p><i>Journey Towards Joy (in Measurement of Iterative Development)</i></p> <p><i>Raj Singh, Connie Bustillo</i></p>	<p><i>Measuring Modularity & Openness in Support of a Modular Open Systems Approach</i></p> <p><i>Dr. Jean Charles Domerçant and Paul Kohl</i></p>	<p><i>Workshop Outbriefs</i></p>
11:00 - 11:40	<p><i>Leading Indicators for Systems Engineering Effectiveness in Digital Engineering Programs</i></p> <p><i>Dr. Donna H. Rhodes</i></p>	<p><i>Collecting Data for the New COCOMO III</i></p> <p><i>Dr. Brad Clark</i></p>	<p><i>Aligning Measurement with System Lifecycle Realities</i></p> <p><i>Tony Powell</i></p>	<p><i>Conference Wrap-up</i></p>
11:40 - 12:20	<p><i>Leveraging DevSecOps to Manage Performance on Mission Critical Programs</i></p> <p><i>Robin Yeman</i></p>	<p><i>Agile Measurement Experiences at Raytheon</i></p> <p><i>Larri Rosser, John Catrone, Robert Simmons</i></p>	<p><i>Managing and Measuring Enterprise Technical Debt</i></p> <p><i>Stephany Bellomo</i></p>	
12:20 - 12:30	<i>Workshop Introductions</i>	<i>Workshop Introductions</i>	<i>Workshop Introductions</i>	

20th PSM Users' Group Meeting and Workshops
"Aligning Measurement with System Life Cycle Realities"

PSM Users' Group 2019 Workshops
Descriptions on following pages
Workshops: Tuesday – Thursday

Workshops: 1:30 to 5:00		
Tuesday	Wednesday	Thursday
<p>1. <i>A Path Toward Consensus Measures for Iterative Software Development</i></p> <p>Facilitators: Geoff Draper, L3 Harris Technologies.; Cheryl Jones, US Army CCDC-AC</p>	<p>4. <i>Journey Towards Joy (in Measurement of Iterative Development)</i></p> <p>Facilitators: Raj Singh, Connie Bustillo, Lockheed Martin</p>	<p>7. <i>Insight from Causal Learning for Improved Policy Making</i></p> <p>Facilitators: Dr. Mike Konrad, Robert Stoddard, and Dr. William Nichols, SEI</p>
<p>2. <i>Adapting Systems Engineering Leading Indicators for Digital Engineering</i></p> <p>Facilitator: Dr. Donna Rhodes, MIT</p>	<p>5. <i>The Application of Nonlinear Regression Methods and Machine Learning to Army Software Maintenance Cost Estimation</i></p> <p>Facilitators: Dr. Christian Smart, Kimberly Roye, Galorath Federal; Paul Janusz, US Army CCDC-AC</p>	<p>8. <i>Measuring Modularity & Openness to Enable MOSA</i></p> <p>Facilitators: Dr. Jean Charles Domerçant, GA Tech; Paul Kohl, Lockheed Martin</p>
<p>3. <i>Measuring the Agile Elephant in The Room – Culture</i></p> <p>Facilitators: David Norton, CISQ</p>	<p>6. <i>Calibrating COCOMO® II for Functional Size Metrics</i></p> <p>Facilitator: Anandi Hira, Dr. Barry W Boehm, Dr. Jim Alstad, Dr. Brad Clark, USC Center for Systems and Software Engineering</p>	<p>9. <i>Agile Estimation with Simple Function Points</i></p> <p>Facilitators: David Seaver, NSA; Lyle Patashnick, NGA; Tyrese Johnson, DHS; Kevin McKeel Logapps, John Sauter, NGC</p>

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Workshop #1: A Path Toward Consensus Measures for Iterative Software Development

Facilitators: Geoff Draper, L3 Harris Technologies.; Cheryl Jones, US Army CCDC-AC

Prerequisites:

- Participants should have a general understanding of the Agile development process.
- Participants should review:
 - The strawman Information Category - Measurement Concept - Measure (ICM) table and measurement specifications for iterative software development (available on the PSM web site, under User Group read-aheads)
 - The SRDR-M for agile programs
 - DSB Report on the Design and Acquisition of Software for Defense Systems (https://www.acq.osd.mil/dsb/reports/2010s/DSB_SWA_Report_FINALdelivered2-21-2018.pdf)
 - Defense Innovation Board metrics for software development (https://media.defense.gov/2018/Jul/10/2001940937/-1/-1/0/DIB_METRICS_FOR_SOFTWARE_DEVELOPMENT_V0.9_2018.07.10.PDF)

Materials to Bring:

- Bring examples of any measures you have used on agile programs
- Bring recommended changes to the agile ICM Table and measurement specifications

Discussion:

Traditional measures used to plan and manage software programs based largely on waterfall development and software lines of code-based estimates are not keeping pace with trends in the defense industry toward methods based in a software factory environment including automated testing, continuous integration, and rapid iterative development and deployment of new capabilities. The Defense Science Board (DSB) and Defense Innovation Board (DIB) recommended measures for continuous iterative development and agile programs. A joint NDIA, INCOSE, and PSM working group surveyed the community for feedback on the usefulness and effectiveness of these measures, and has been developing a framework based on information needs to help reach industry consensus on candidate measures.

During this workshop, the strawman ICM table and sample measurement specifications will be reviewed and updated. Volunteers for development of additional measurement specifications will be solicited.

Goals/Products:

- ICM Table and measurement specifications for agile measurement that are ready for use
- Plan for white paper on measurement for continuous iterative development including an outline and writing assignments

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Workshop #2: Adapting Systems Engineering Leading Indicators for Digital Engineering

Facilitator: Donna Rhodes, Principal Research Scientist, MIT

Prerequisites:

Prior to the workshop, attendees should review:

- **SE Leading Indicators Guide, Version 2.0**
<http://www.psmc.com/Downloads/Other/SELI-Guide-Rev2-01292010-Industry.pdf>
- **DoD Digital Engineering Strategy**
https://www.acq.osd.mil/se/initiatives/init_de.html

Materials to Bring: Attendees are encouraged to bring any examples of new/adapted measures used in digital engineering (model-based/model-centric) programs

Discussion: Over the past decade a body of work on systems engineering leading indicators has emerged, as a predictive measurement approach for systems engineering effectiveness on traditional acquisition programs. With the ongoing digital engineering transformation, there is an opportunity to re-examine the leading indicators to understand what adaptations and additional leading indicators are needed for future digital engineering/model-centric programs. This workshop is intended to gather knowledge and insights from experts in field in support of ongoing research that seeks to (1) investigate the adaption and extension of the systems engineering leading indicators for digital/model-based engineering practice and resulting digital artifacts; and (2) investigate how program leaders can proactively assess systems engineering effectiveness in digital/model-centric programs using leading indicators.

Goals and products:

The goals of the workshop are:

- Identify existing leading indicators published in the current SE Leading Indicators Guide that are perceived to be useful in model-centric/digital engineering programs, including useful as-is and/or useful if adapted
- Share insights and experiences with novel adaptation/new measures as measures of effectiveness of systems engineering in model-centric (digital engineering) programs
- Identify areas where potential new leading indicators could be beneficial to program leaders in assessing systems engineering effectiveness in digital engineering programs

The products of the workshop are:

- Prioritized list of existing leading indicators that are candidates for being adapted
- Top 5 proposed new leading indicators to augment/replace existing leading indicators
- Insights on what information program leaders need to assess engineering effectiveness that is unique to digital engineering/digital environments.

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Workshop #3: Measuring the Agile Elephant in The Room – Culture

Facilitator: *David Norton, Executive Director, CISQ*

Prerequisites:

- The need to assess the culture of the organization related to actual transformation

Materials to Bring: None

Discussion: Gain insight into how to measure agile behavior and its impact on the engineering process.

Ask anybody what the most important thing with and Agile DevOps and they is will say culture. However, if you then go on and ask what steps their organisation takes to measure culture the normal answer is none or very little. Culture, and more specifically behaviour, is seen as an intangible that cannot be measured - this could not be further from the truth. There are many agile frameworks focused on behaviour that allow us to measure and assess the behaviour of our teams and leaders.

The workshop will focus on the practicalities of measuring agile behaviour and aligning it with the mission outcomes. And how this can be done in a no-nonsense, practical way.

Goals and products:

The goals of the workshop are:

- Draft a behavior measurement plan

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Workshop #4: *Journey Towards Joy (in Measurement of Iterative Development)*

Facilitator: *Raj Singh, Connie Bustillo, Lockheed Martin*

Prerequisites:

- Fundamental knowledge of agile methods and base measures
- Familiarity of your company's existing measures
- Additional insights needed

Materials to Bring:

- Current measures and metrics in use
- Problems/gaps of current measures
- List of needs for your specific program

Discussion:

- Merits, pros/cons of specific needs
- Dependencies, enablers, contributors
- Strategic Roadmaps

Agile as a product development paradigm is increasingly becoming a DoD recommendation and an imperative for future programs based on the need for velocity in delivering contracted capabilities. Managing Agile development and value streams for these large-scale programs requires a blend of insights across planning, execution, and efficiency gains.

This workshop will discuss a framework of measurement and insights across these fundamental needs and the drivers for the same, as well as how these metrics are consumed. It will also discuss consumers of these insights and resulting appropriate actions and reactions.

The workshop will also provide an opportunity for the participants to engage in discussion on specific and unique needs and develop a strategy and/or roadmap for piloting and developing the corresponding metrics.

Goals/Products:

- Strategic roadmap per participants' needs

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Workshop #5: The Application of Nonlinear Regression Methods and Machine Learning to Army Software Maintenance Cost Estimation

Facilitator: *Dr. Christian Smart, Kimberly Roye, Galorath Federal; Paul Janusz, US Army CCDC-AC*

Prerequisites:

- None identified

Materials to Bring:

- Examples of cost estimation methods using nonlinear and machine learning approaches.

Discussion:

The scope of software projects varies widely. Dues to economies - and more often diseconomies - of scope, nonlinear cost estimating relationships are more appropriate than linear ones. The use of log-transformed ordinary least squares is a traditional method, but one of its main drawbacks is that it is biased low. In this workshop, attendees will discuss this issue; and available modern nonlinear regression techniques to develop cost estimating relationships to overcome this will be discussed in detail. Additionally, attendees will be provided an overview of a variety of supervised learning methods that can also be used for predictive analysis and practice applying some of these techniques in estimating.

Goals/Products:

- Learn how to implement modern regression methods and gain exposure to machine learning methods for predictive cost analysis.

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Workshop #6: Calibrating COCOMO® II for Functional Size Metrics

Facilitators: *Anandi Hira, Dr. Barry W Boehm, Dr. Jim Alstad, Dr. Brad Clark, USC Center for Systems and Software Engineering*

Prerequisites:

Attendees should be familiar with software development at a project level, either as project lead, estimator, or engineer. Experience with IFPUG Function Points and/or COSMIC Function Points advised. Previous experience estimating software development cost is very helpful. Experience with COCOMO® II or other software estimation models would also be helpful.

Materials to Bring:

Experience with IFPUG/COSMIC Function Points or other types of cost estimation; estimating, leading, or working on software development. If possible, data from completed software projects.

Discussion:

The purpose of the Workshop is to adjust the COCOMO® II parameters with respect to IFPUG and COSMIC Function Points (instead of Source Lines of Code (SLOC)). Since SLOC represents software size at a much lower level of granularity compared to functional size metrics, the effects various effort factors have on effort may need to be adjusted. Particularly the 5 Scale Factors (Precedentedness, Development Flexibility, Team Cohesion, Risk and Architecture Resolution, and Process Maturity), which affect the rate at which effort grows with respect to size. The ratings of these 5 scale factors can set the exponent on Size to a range from 0.9 to 1.2.

Expert input will be gathered via a Wideband Delphi. The session will include a detailed presentation on parameter definitions. Attendees will be presented with a questionnaire of parameter values, which they will submit anonymously; then the responses will be summarized and presented for discussion. After that, a second round will be conducted, where attendees will again submit parameter values, this time in light of the results of the first round and its discussion. For each parameter, additional rounds can be conducted until the results stabilize, as time permits.

Goals/Products:

- Feedback on the relationship between effort and functional size metrics.
- Results of the Wideband Delphi: simple statistics (average, standard deviation, etc.) for the expert opinions for each parameter.
- Interest in providing actual project data to calibrate and validate the adjusted COCOMO® II model (for functional size metrics)

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Workshop #7: Insight from Causal Learning for Improved Policy Making

Facilitators: Dr. Mike Konrad, SEI; Robert Stoddard, SEI; and Dr. William Nichols, SEI

Prerequisites:

- (1) A basic knowledge of statistics and/or machine learning
- (2) Attendance in the morning presentation "Do Software Architecture Patterns Reduce Security Vulnerabilities? Insight from Causal Learning"

Materials to Bring:

- (1) Pre-read a *book review* of "The Book of Why: The New Science of Cause and Effect."
<https://www.nytimes.com/2018/06/01/business/dealbook/review-the-book-of-why-examines-the-science-of-cause-and-effect.html>

The book review does a good job of summarizing takeaways from the book.

- (2) Optional: for those interested in exercising causal search algorithms: a laptop with Windows to receive and exercise the Tetrad causal discovery tool on a practice data set. A project or organizational dataset may also be brought; however, the SEI will provide an example dataset along with the Java runtime environment and Tetrad software needed to analyze it.

Discussion:

Just as deep learning has upended how we think about creating software for classification and prediction in data-rich domains, so too will causal learning upend how we estimate and control software development, sustainment, and acquisition. The change is more than a technical one—it requires a change in how we think about the larger ecosystem of multiple stakeholders, technology, and agendas to achieve cost-effective software performance and quality.

The Software Engineering Institute (SEI) is now entering the third year of a three-year research project to apply modern advances in causal learning (search and estimation) along with Tetrad tooling to go beyond traditional correlation and regression analyses and more accurately identify the causal relationships among software process and product factors and program outcomes. Our early use of causal learning suggests that many (up to 80%) of statistically-significant factors (and intuitions) do not confirm as causally-related to outcomes. As a result, a program manager's focus is often misdirected to less-effective leverage points when estimating or controlling their program, with consequential loss of opportunity for more cost-effective program execution.

This workshop seeks to enlighten the practical systems and software measurement community and encourage joint collaboration in the early adoption of causal learning to improve the quality (and toolkits) of systems engineering and software cost estimation research.

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Workshop #7: Insight from Causal Learning for Improved Policy Making (cont.)

Goals/Products:

The workshop will produce the following:

- 1) A group statement to the PSM community on:
 - a. Why causal analysis must be considered as part of measurement and analysis practice when analyzing data to guide policy makers
 - b. What changes in mindset are required by stakeholders (policy makers, program managers) to correctly interpret and apply the results of a causal analysis
 - c. What other changes are needed in the broader systems engineering and software community to make more effective use of causal analysis and tools
- 2) A working discussion in small groups followed by a final large group summary of:
 - a. Research questions and hypotheses worthy of causal learning (a continuation from last year's PSM 2018 workshop)
 - b. Data sources helpful in causal learning research
 - c. Next steps that workshop attendees plan to take to help the PSM community grow in knowledge and appreciation for causal learning

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Workshop #8: Measuring Modularity & Openness to Enable MOSA

Facilitator: *Dr. Jean Charles Domerçant, Georgia Tech Research Institute; Mr. Paul Kohl, Lockheed Martin Corporation*

Prerequisites:

- An understanding of general measurement approaches and current approaches to measuring modularity and openness, along with an understanding of the move towards MOSA
- Recommended reading:
 - [Defense Acquisition University Notes on MOSA](#)
 - [MIL-STD 881](#) "Work Breakdown Structures for Defense Materiel Items"
 - F. B. e Abreu and M. Goulao, "Coupling and cohesion as modularization drivers: Are we being over-persuaded?," in Fifth European Conference on 2001, IEEE, 2001.
 - J. Al Dallal, "Mathematical validation of object-oriented class cohesion metrics," International Journal of Computers, vol. 4, no. 2, pp. 45-52, 2010.
 - MOSA Community of Practice: [MOSA Tools](#)
- Recommend attending the following presentation: Measuring Modularity & Openness in Support of a Modular Open Systems Approach

Materials to Bring:

Measures and measurement approaches for modularity and openness.

Discussion:

A Modular Open System Approach (MOSA) has been recently mandated by the Secretaries of the Army, Air Force, and Navy for future weapon modifications and new start developments to the maximum extent possible. This workshop will present an overview of the key aspects for defining and measuring both modularity and openness, to provide an objective means of self-assessment to aid in certification of MOSA compliance.

Goals/Products:

- Develop and apply useful tools and measures of modularity and openness to aid in MOSA
- Develop and apply a measurement framework that captures technology insertion, modularity purpose, and reuse as the main drivers that determine the technical implementation of modularity.
- Provide a mapping from reuse objectives to a Return-on-Investment (ROI) so that cost-benefit tradeoffs of MOSA can be evaluated

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Workshop #9: Agile Estimation with Simple Function Points

Facilitator: *David Seaver, NSA; Lyle Patashnick, NGA; Tyrese Johnson, DHS; Kevin McKeel, Logapps, John Sauter, NGC*

Prerequisites:

- A Background Software Estimation and Agile or DevOPS Concepts
- Participants should review:
 - Simple function points description, manual, and examples (available on the PSM web site, under User Group read-aheads)

Materials to Bring:

- Notebook

Discussion:

The three Federal Agencies and the two companies represented above have been using Simple Function Points for estimation and measurement for Agile and DevOPS projects (and waterfall too) for several years. The proposed Workshop is designed to provide a basic tutorial to familiarize the audience with the SFP process, provide a basic tutorial how the process works, and to discuss how the community is applying SFP and EVM to estimate and measure projects and programs. The intent is to share this work with the community in the hope that we can enlist other participants to collaborate with us in this activity.

Goals/Products:

The group has four themes it would like to illustrate and discuss with the PSM community with the intent of enlisting additional collaboration

- Audience becomes familiar with SFP
- Tutorial on how SFP works in practice to estimate
- Measurement and EVM with SFP
- Automation of SFP

Presentation Abstracts
Tuesday

Keynote Presentation

Title: Defense Innovation Board (DIB) Measures – OUSD A&S Implementation

Presenter: Dr. Jeff Boleng, OUSD A&S

Abstract: The rise of electronics, computing, and networking has forever transformed the way we live: software is a part of almost everything with which we interact in our daily lives, either directly through embedded computation in the objects around us or indirectly through the use of information technology through all stages of design, development, deployment, and operations. Our military advantage, coordination with allies and partners, operational security, and many other aspects of the DoD are all contingent upon our software edge and any lack thereof presents serious consequences. Software drives our military advantage: what makes weapons systems sophisticated is the software, not (just) the hardware.

Commercial trends show what is possible with software, from the use of open source tools to agile development techniques to global-scale cloud computing. Because of these changes, software can be developed, deployed, and updated much more quickly, which means systems need to be in place to support this speed. But modern software development requires a new set of skills and methodologies (e.g., generalist software engineers, specialized product management, DevOps and DevSecOps, agile development). Hence, the policies and systems surrounding software must be transformed to support software, not Cold-War era weapon manufacturing.

In the Defense Innovation Board report on software, the authors studied the methods that the private sector has used to enable software to transform its operations and considered how to best apply those practices to the defense enterprise. Three primary themes emerged as the basis for the recommendations:

1. Speed and cycle time are the most important metrics for software.
2. Software is made by people and for people, so digital talent matters.
3. Software is different than hardware (and not all software is the same).

In this presentation, Dr. Boleng will summarize some of the key recommendations for changes to software development in the Department of Defense, and the measures that are recommended to monitor these changes. Dr Boleng will discuss OUSD A&S recommendations for measurement and the planned approach to their implementation.

Title: Technical Measurement Working Group: MOEs, KPPs, MOPs, and TPMs

Presenters: Garry Roedler, Lockheed Martin; Cheryl Jones, U.S. Army CCDC-AC

Abstract: The In 2005, PSM published the technical measurement guide, providing information on implementing technical measurement on a project. Technical measurement includes Measures of Effectiveness (MOEs), Key Performance Parameters (KPPs), Measures of Performance (MOPs), and/or Technical Performance Measures (TPMs).

Over the next year, PSM will update this guide. This short presentation will describe the plan for completing a new survey to understand current technical measures in use today and then updating this measurement guide.

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Title: A Path Toward Consensus Measures for Iterative Software Development

Presenters: Geoff Draper, L3 Harris Technologies; Cheryl Jones, US Army CCDC-AC

Abstract: Traditional measures used to plan and manage software programs based largely on waterfall development and software lines of code-based estimates are not keeping pace with trends in the defense industry toward methods based in a software factory environment including automated testing, continuous integration, and rapid iterative development and deployment of new capabilities. The Defense Science Board (DSB) and Defense Innovation Board (DIB) recommended measures for continuous iterative development and agile programs. A joint NDIA, INCOSE, and PSM working group surveyed the community for feedback on the usefulness and effectiveness of these measures, and has been developing a framework based on information needs to help reach industry consensus on candidate measures. This presentation will summarize current recommendations, feedback from the community, and path forward on a consensus measurement framework.

Title: Leading Indicators for Systems Engineering Effectiveness in Digital Engineering Programs

Presenter: Donna H. Rhodes, Principal Research Scientist, MIT

Abstract: The ongoing transformation of traditional systems engineering to digital engineering makes it necessary to re-examine how we assess the effectiveness of systems engineering on DoD programs. More than a decade ago, a group of systems experts from industry, academia and government collaborated to develop the Systems Engineering Leading Indicators Guide, aimed at predictive assessment of systems engineering effectiveness during the program system lifecycle. The guide details eighteen leading indicators using the PSM measurement specification format, and provides useful measurement guidance and practitioner insights. The guide, however, was developed under the assumptions of traditional systems engineering. With the transformation to digital engineering, the question arises as to whether these leading indicators are still useful and what modification may be required. This presentation will discuss the challenges and opportunities for investigating how program leaders can proactively assess systems engineering effectiveness under the digital engineering paradigm. Highlights of an ongoing research project investigating the adaptation of leading indicators in response to digital engineering will be shared.

Title: Leveraging DevSecOps to Manage Performance on Mission Critical Programs

Presenter: Robin Yeman, Lockheed Martin Fellow, Space

Abstract: In this presentation, Ms. Yeman will define DevSecOps and provide examples of programs using DevSecOps. Measures that are key indicators to success will be presented and discussed.

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Presentation Abstracts
Wednesday

Title: New Army Software Sustainment Cost Estimating Results

Presenters: Cheryl Jones, US Army CCDC-AC, James Doswell, US Army DASA-CE

Abstract: The Army has conducted a study over the past six years to improve the estimation accuracy of software sustainment systems cost. Based on an extensive data call of 192 Army systems, data analysis revealed several types of cost estimating relationships based on release type, release rhythm, and three categories of data. Analysis of a sustainment cost risk model was also conducted. This presentation will show the study results including what worked and did not work. A paper providing additional detail on this presentation is available.

Title: The Application of Nonlinear Regression Methods to Army Software Maintenance Cost Estimation

Presenters: Dr. Christian Smart, Kimberly Roye, Galorath Federal

Abstract: The scope of software projects varies widely. Dues to economies - and more often diseconomies - of scope, nonlinear cost estimating relationships are more appropriate than linear ones. The use of log-transformed ordinary least squares is a traditional method, but one of its main drawbacks is that it is biased low. In this presentation, we discuss this issue; present modern nonlinear regression techniques to develop cost estimating relationships to overcome this shortcoming; and apply the methods to estimating software maintenance cost for a large dataset of Army program software releases.

Title: Journey Towards Joy (in Measurement of Iterative Development)

Presenters: Raj Singh, Connie Bustillo, Lockheed Martin

Abstract: The measurement of iterative product development is an evolving landscape that requires a paradigm change, focusing on measures aligned with agile tenets. These insights may seem different and unfamiliar at first glance but support the fundamentals of iterative product development by measuring the integrity of plans, execution and organizational efficiencies.

This presentation recommends a framework of measurement across these fundamentals, with a feasible base of system health indicators, middle layers of usable critical metrics and useful key performance measures, and a joyous summit of strategic performance measures. Traversing the framework requires aggregation of data into information, knowledge, and business intelligence while providing predictive insights, trends and correlations where possible.

During this session, the presenter will also share experiences and lessons learned in the journey so far, and path towards joy.

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Title: Collecting Data for the New COCOMO III

Presenters: Dr. Brad Clark, Adjunct Professor, USC Center for Systems and Software Engineering.

Abstract: The COCOMO III model is an update on the popular COCOMO II Software Cost Estimation Model. A draft version of the model has been formulated and the next step is to calibrate the model to real-world data. The updates to the new model include functional size inputs, a new Software Security parameter, removal of a couple of COCOMO II parameters and an update to some of the pre-existing COCOMO II parameters.

This presentation will discuss the data collection mechanism for the COCOMO III model as well as data collection procedures.

Title: Agile Measurement Experiences at Raytheon

Presenters: Larri Rosser, John Catrone, Robert Simmons, Raytheon

Abstract: To be Specified

Presentation Abstracts ***Thursday***

Title: Panel: Agile Estimation with Simple Function Points

Presenters: David Seaver NSA; Lyle Patashnick NGA; Katie Noreiga, DHS, Paul Cymerman, Quaternion Consulting

Abstract: The three Federal Agencies and the company represented above have been using Simple Function Points (SFP) for estimation and measurement for Agile and DevOPS projects (and waterfall too) for several years. During this panel, each organization will discuss how they are implementing simple function points to estimate and measure projects and programs, and data findings related to this approach.

20th PSM Users' Group Meeting and Workshops **“Aligning Measurement with System Life Cycle Realities”**

Title: Do Software Architecture Patterns Reduce Security Vulnerabilities? Insight from Causal Learning

Presenters: Robert Stoddard, SEI; Rick Kazman, SEI, Dr. Mike Konrad, SEI, Dr. William Nichols, SEI, Selma Suloglu, RIT, and David Danks, CMU

Abstract: While few would argue that architectural patterns are important to achieving a good balance between efficient software execution and long-term modifiability of code, the implications for software security are not clear. In this presentation, we present recent results from our application of causal learning to the question of whether a disciplined architectural approach to constructing software can improve software security. We answer this question by applying automated tools to analyze about a dozen open source projects for architectural pattern violations and code vulnerabilities. While classical statistical analyses can provide insight into the correlational structure of observational data; only causal analyses can provide insight into causal relationships that can be the basis of improved estimation, decision making and design policy in software development, which is our goal. This year's presentation is part of a continuing series of studies by the SEI on the efficacy of architectural practices.

Title: Measuring Modularity & Openness in Support of a Modular Open Systems Approach

Presenters: Dr. Jean Charles Domerçant and Paul Kohl

Abstract: A Modular Open System Approach (MOSA) has been recently mandated by the Secretaries of the Army, Air Force, and Navy for future weapon modifications and new start developments to the maximum extent possible. This is a result of rapid changes in mission capability and computing technology and an increased emphasis on interoperability and modularity to ensure continued dominance. However, this has caused exponential increases in cost and complexity that threaten the sustainability of the Department of Defense's (DoD) current path of systems development. Furthermore, proprietary architectures and designs lock the government to a single vendor and prevent a “best of breed” approach to capability integration. MOSA provides both a business and technical approach to mitigate these effects, however, to ensure timely, efficient, and effective MOSA implementation, measures of both modularity and openness must be developed to guide the acquisition of systems using MOSA. The focus of this presentation is to outline a framework that develops the necessary measures of modularity and openness. Doing so provides an objective means of self-assessment to aid in certification of MOSA compliance.

Title: Aligning Measurement with System Lifecycle Realities

Presenters: Dr Antony Powell, Dr John Murdoch, YorkMetrics

Abstract: This presentation will directly explore the theme of this year's PSM workshop 'Aligning Measurement with System Lifecycle Realities'. It reviews the current status and emerging trends in software and systems engineering across their lifecycles and the implications for engineering management. The concept of measurement 'alignment' is then explored with reference to the changing context of software and systems engineering. The implications are discussed in terms of active measurement on UK defense projects, including modular open systems, interoperability, agile methods, sustainment, affordability and estimation. In doing so we make practical recommendations on how measurement can be successfully aligned to these new realities.

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Title: Managing and Measuring Enterprise Technical Debt

Presenters: Stephany Bellomo, SEI

Abstract: We How many times have you seen huge IT modernization budgets expended, yet enterprise IT problems persist costing thousands of dollars in workarounds? Meanwhile, IT modernization outcomes amount to server upgrades and a few pet pilot projects. As an enterprise architecture team for a large government organization (50+ systems) over the past 5 years, we know the importance of making enterprise IT problem data visible to avoid this scenario. In our work, we refer to enterprise IT problem data (with quantifiable impact) as Enterprise Technical Debt. An example of Enterprise Technical Debt from the organization we are working with is decentralized authentication and access control in which projects duplicate this functionality resulting in enterprise-wide increased maintenance and security risk. In this talk, we provide examples of Enterprise Technical Debt and explain how we have used it to measure enterprise modernization progress for the organization.

Presentation Abstracts ***Friday***

Title: Struggles at the Frontiers of Systems Engineering and Measurement: Special Focus - Aligning Measurement with System Life Cycle Realities

Presenter: Dr. Kenneth E. Nidiffer, PMP

Abstract: This presentation focuses on efforts of organizations to enhance their systems engineering approaches for defining effective system and software measures over the acquisition lifecycle for software-reliant systems with special emphasis on software sustainment. Specifically it addresses the gaps and struggles between systems and software engineering in the area of system and software information needs and the associated evolution for new core competencies needed by the systems and software engineering workforces due, in part, to the blurring of lines between the digital-physical world in advanced systems, the emergence of artificial/machine-learning systems, and dynamic increases in software functionality in modern systems.

Software is a critical part of virtually all of today's economic, social, and military systems, driving much of their complexity and emergent behavior. At the same time, most software is tightly integrated with hardware in systems that must operate in the physical world. The tight coupling of systems and software creates measurement challenges across the life cycle of systems engineering activities. System and software engineering information needs are different. A core underlying issue is, as Dr. Brooks noted, "software is unlike other forms of engineering as other forms of engineering are like unto themselves," which has resulted in misunderstandings and disconnects among approaches taken by software and systems engineers in aligning measurement with system life cycle realities.

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This presentation charts the evolving struggle to adequately define systems and software measures associated with software intensive systems. These struggles are critical to the successful development of complex cyber-centric physical systems and the significant challenges to the effective continuous iterative development and sustaining of most computational systems. The central argument is that there is an ever-growing need to define measures that address these emerging technology trends. The presentation reviews the results of efforts to address the gaps and struggles of building-in effective measures in complex large-scale systems. It leverages relationships with industry and early adopters of more modern delivery cycles to synthesize relevant guidance into an evolving body of knowledge specific to industrial and government acquisition and sustainment settings for software-intensive systems. It also leverages a two-year study that the author participated in to address the technological and acquisition changes needed in software and systems engineering to enable a more responsive acquisition environment and recent Defense Innovation Board and Defense Science Board studies.

Title: Agile Measurement within the Armament SEC

Presenters: Costello, Christopher, US Army CCDC-AC

Abstract: The speaker is the measurement team lead for the CCDC Armaments Center, Armament Software Engineering Center (SEC) responsible for the organization's measurement approach of collecting and reporting practical and effective project and organizational measurements. The Practical Software and Systems Measurement (PSM), ISO/IEC 15939: Software Measurement Process, and CMMI V2.0 Managing Performance and Measurement Practice Area are used as a basis for the Armament SEC organizational measurement and analysis procedure. This presentation will discuss the process of identifying, piloting, evaluating, and instituting new Agile measures within the Armament SEC. These efforts began after the Armament SEC approved the Agile lifecycle model for use by development teams in the organization. The Armament SEC is currently piloting five Agile measures that are structured using the PSM Measurement Construct. The presentation will provide insight into the rationale for selecting the measures being piloted, how they are being calculated, their Measurement Construct, and an overview of the role of the Measurement Team in the Process Engineering Group (PEG).
