National Defense Industrial Association

The Evolution of DoD SW Acquisition and Measurement

An industry/DoD collaboration

Cheryl Jones

Army Futures Command – CCDC Armament Center
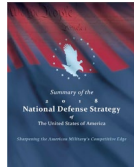
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NDIA SE Division – Feb 2020

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The Evolution of DoD SW Acquisition and Measurement

National Defense Strategy 2018

"Performance at the speed of relevance" Streamline rapid, iterative approaches

Hon. Ellen M. Lord USD (A&S)

Jeff Boleng Special Ass't for SW Acquisition

2018 NDAA (Sec. 872)
• DIB analyze SW regs

2019 NDAA (Sec. 868)
• Implement DSB recommendations

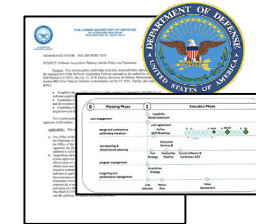Defense Innovation Board (DIB) Software Acquisition and Practices (SWAP) https://innovation.defense.gov/software/

Software Is Never Done Refactoring the Acquisition Code for Competitive Advantage Defense Innovation Board May 3, 2019

• 3 Themes
• 4 Lines of Effort
• Top 10 recommendations
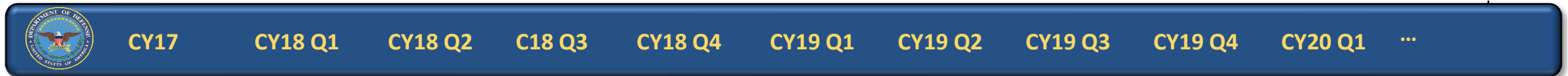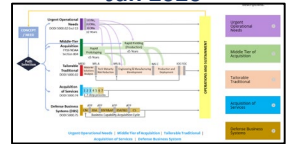• DevSecOps
• Implementation plans

DIB SWAP May 2019

2020 NDAA
• Implement DIB recommendations

SW Acq Pathway Interim Policy and Procedures Jan 2020

Adaptive Acq Framework Guidance, training https://aaf.dau.edu/aaf **Jan 2020**

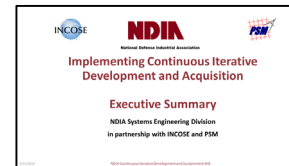| CY17 | CY18 Q1 | CY18 Q2 | C18 Q3 | CY18 Q4 | CY19 Q1 | CY19 Q2 | CY19 Q3 | CY19 Q4 | CY20 Q1 | ... |

DSB SW Feb 2018

Aug 2018

7 recommendations
• SW factories
• CID
• Risk reduction, metrics
• Current & legacy programs
• Workforce
• IV&V for machine learning

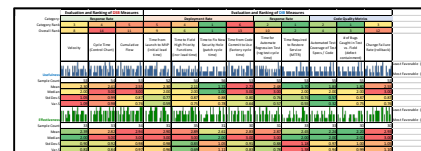Defense Science Board Design and Acquisition of Software for Defense Systems

NDIA/INCOSE/PSM CID WG Mar 2019

Implementing Continuous Iterative Development and Acquisition

Executive Summary

NDIA Systems Engineering Division in partnership with INCOSE and PSM

http://www.ndia.org/divisions/systems-engineering/studies-and-publications

Industry recommendations for Implementing DSB findings

Industry Surveys (NDIA, INCOSE, PSM)

PSM User Group CID Workshop Sep 2019

Draft A&S SW Metrics

CID Measurement Framework PSM/INCOSE/NDIA Jan 2020

Continuous Iterative Development Measurement Framework Version 0.8 January 10, 2020

• Information Needs
• Measurable Concepts
• Indicator Specifications
• Guidance

SW CID Measures

Metrics

DSB

[S]
*Sprint burndown
*Epic and release burndown
*Velocity
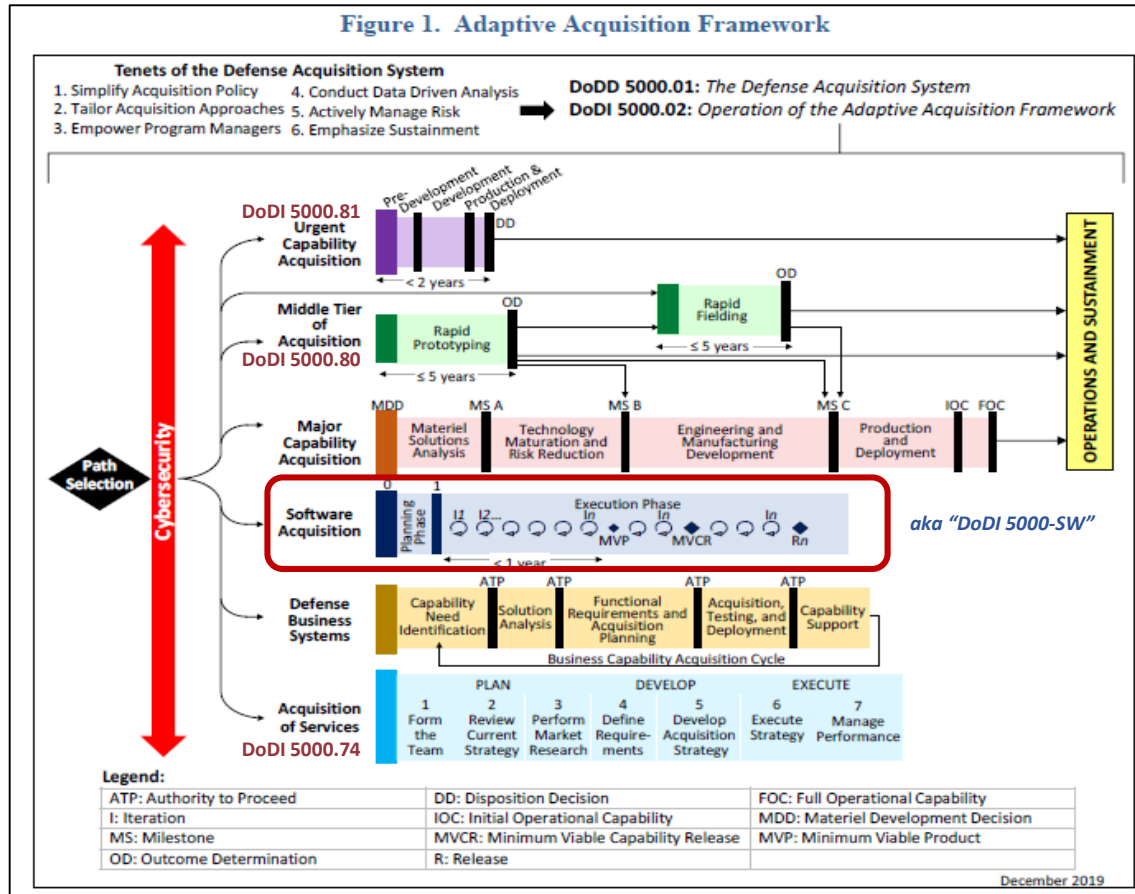*Cycle time (control chart)
*Cumulative flow

DIB

Draft OUSD A&S SW Policy
Story points
*Velocity
Story completion rate
*Sprint burndown chart
Recidivism rate
Number of blockers
Delivered features
Delivered value points
Level of user satisfaction
Mean Time to Restore (MTTR)
*Deployment frequency
*Change fail rate – defect counts
*Total cost estimate
Burn rate

PSM Continuous Iterative Development (CID) Measurement Framework
http://www.psmsc.com/CIDMeasurement.asp

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DoD Acquisition Pathways (DoDI 5000.xx)

Adaptive Acquisition Framework

Figure 1. Adaptive Acquisition Framework

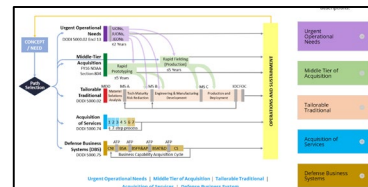Tenets of the Defense Acquisition System
1. Simplify Acquisition Policy
2. Tailor Acquisition Approaches
3. Empower Program Managers
4. Conduct Data Driven Analysis
5. Actively Manage Risk
6. Emphasize Sustainment

DoDD 5000.01: The Defense Acquisition System
DoDI 5000.02: Operation of the Adaptive Acquisition Framework

- DoDI 5000.81 — Urgent Capability Acquisition (< 2 years)
- DoDI 5000.80 — Middle Tier of Acquisition (Rapid Prototyping, Rapid Fielding, ≤ 5 years)
- Major Capability Acquisition (MDD, MS A, MS B, MS C, IOC, FOC)
- Software Acquisition aka "DoDI 5000-SW" (< 1 year)
- Defense Business Systems
- DoDI 5000.74 — Acquisition of Services

Legend:
- ATP: Authority to Proceed
- I: Iteration
- MS: Milestone
- OD: Outcome Determination
- DD: Disposition Decision
- IOC: Initial Operational Capability
- MVCR: Minimum Viable Capability Release
- R: Release
- FOC: Full Operational Capability
- MDD: Materiel Development Decision
- MVP: Minimum Viable Product

December 2019

Published on DoD Directives Division website as of 1/12/20:
https://www.esd.whs.mil/Directives/Recent-Publications/

Guidance: https://aaf.dau.edu/aaf

Interim Policy

- **Policy**
- **Responsibilities**
- **Procedures**
- **Glossary** (acronyms, definitions)
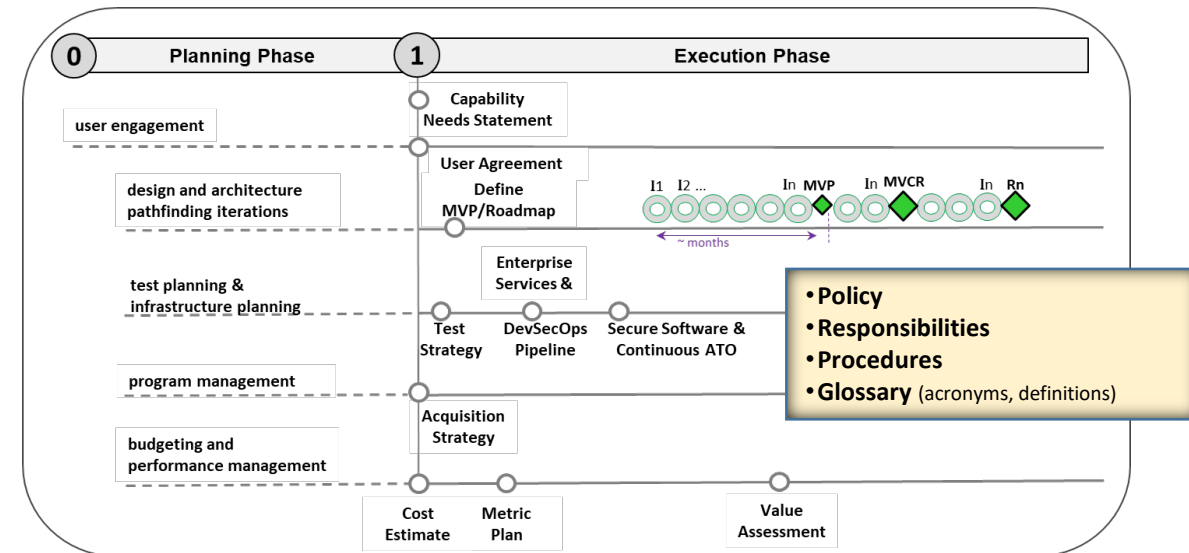
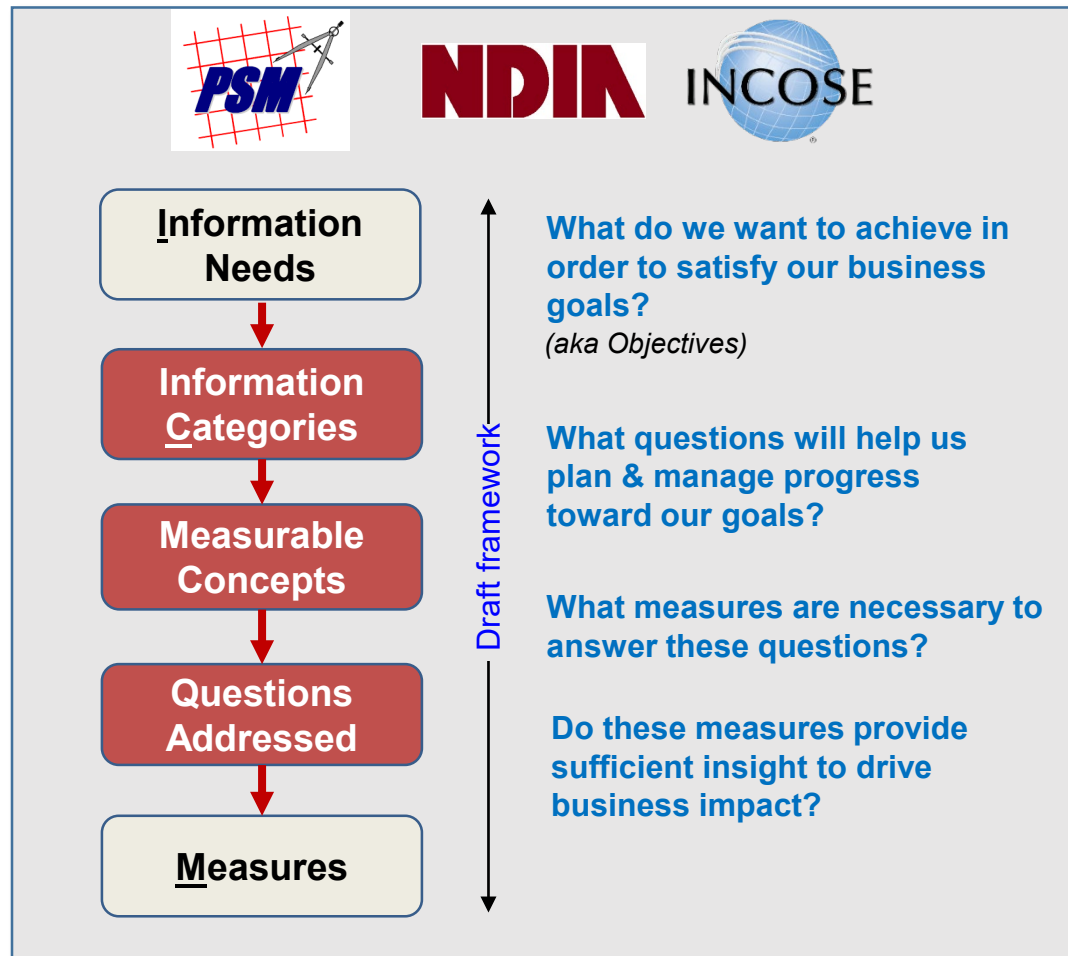| Software Acquisition Products	Key Concepts and Considerations
• Capability Needs Statement (CNS) • User Agreement (UA) (end user engagement) • Acquisition Strategy (AS) • Cost estimates • Product Roadmap • Test Strategy (DT/OT) • Secure Software & Cybersecurity Plan • Metrics plan • Value assessments (annual)	• Acquisition agility, tailoring • Integration (SW, SE, PM, Security, DT/OT) • Enterprise services • DevSecOps pipeline (secure software, Continuous ATO) • Architecture-centric development • Rapid delivery (MVP, MVCR) • Continuous integration/delivery • Actionable performance measures

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Overview – SW Measurement Framework

Information Needs

What do we want to achieve in order to satisfy our business goals?
(aka Objectives)

Information Categories

What questions will help us plan & manage progress toward our goals?

Measurable Concepts

What measures are necessary to answer these questions?

Questions Addressed

Do these measures provide sufficient insight to drive business impact?

Measures

Draft framework

PSM, NDIA, and INCOSE collaborated on development of a consensus industry measurement framework for agile/CID

PSM Continuous Iterative Development (CID) Measurement Framework
http://www.psmsc.com/CIDMeasurement.asp

NDIA WG recommendations: DSB #3 (measures)

Picture of Success (end state)	
Consensus frameworks	• Objectives first - measures aligned and tailored from information needs, goals and constraints, at program and enterprise levels
Modernized measures	• Migration toward consensus alternatives to traditional waterfall and phase-based SW measures (LOC, EVM, milestones, …) • Derived from SW factory processes, automated by toolchain • Basis for measuring cost and schedule vs. plan
History-based estimates	• Repositories collect performance-based measures (e.g., WBS, staff, cost, productivity) supporting future comparisons, basis of estimates, proposals, and program monitoring

V1.0 of the PSM CID measurement framework prioritizes the most critical information needs and measures based on stakeholder surveys and feedback

http://www.psmsc.com/CIDMeasurement.asp
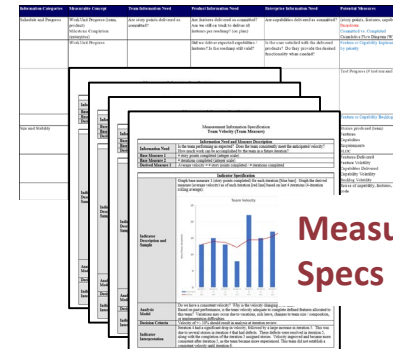
ICM Table
• Information Categories
• Measurable Concepts
• Information Need (team, product, enterprise)
• Potential measures

Measurement Specs
• Information Need
• Measures (base, derived)
• Indicator description, sample

• Analysis model
• Decision criteria
• Interpretation, guidance
• Implementation considerations

Automated Test Coverage	Burndown (Sprint/Release)	Committed vs. Completed	Cumulative Flow
Cycle Time / Lead Time	Defect Detection	Defect Resolution	MTTR / MTTD
Release Frequency	Team Velocity	…	

Acknowledgments

Continuous Iterative Development Measurement Framework

Developed and Published by Members of: PSM NDIA INCOSE

1.2 CONTRIBUTORS

Table 1: CID Measurement Framework Editors

Editors	Organization
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Bill Golaz	Lockheed Martin Corporation
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Table 2: Core Team Contributors and their Organization

Core Team	Organization
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Suzette Johnson	Northrop Grumman Corporation
Jonathan Kiser	Boeing Company Corporation
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Continuous Iterative Development Measurement Framework

Developed and Published by Members of: PSM NDIA INCOSE

Additional thanks go to the many additional colleagues who contributed to the development of the guide thorough participation in meetings, workshops and reviews.

Table 3: Additional Contributors to the Paper

Additional Contributors	Organization
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Roz Singh	Raytheon Company
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Marilyn Vickers	US Air Force

Thank you to the many contributors from PSM, NDIA, and INCOSE that helped to develop the CID Measurement Framework!
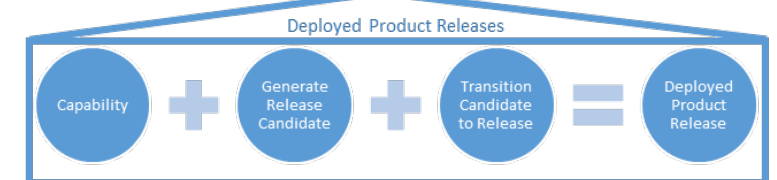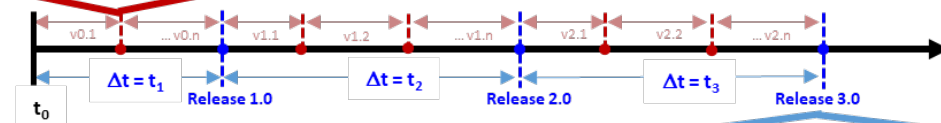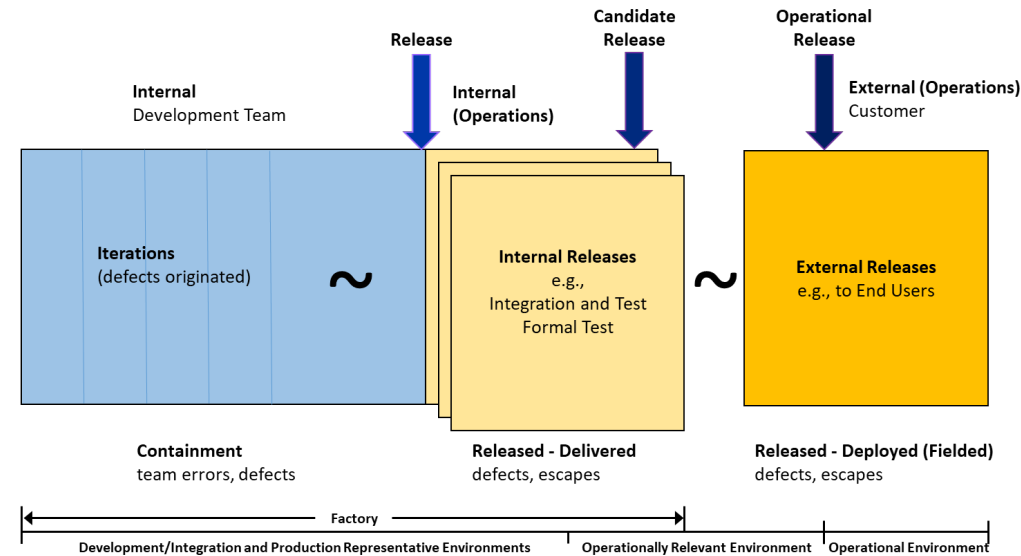
PSM CID Measurement Framework
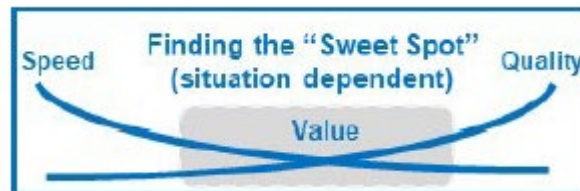
Examples

PSM CID Measurement Concepts
Terminology, Releases

Term	Synonyms	Description
Internal release		A release that is ready for internal use outside of the development team. It may be used for integration, testing, or demonstration.
Candidate Release	External Release	An release that has been through the pipeline and system test, and is ready for transition to the user.
Operational Release	Deployment Release	A release that has been approved for operational use.
Iteration	Sprint	A small internal time block in which the development team develops and demonstrates a set of Stories. An iteration is a full development cycle that can result in a Release. In some methodologies, an iteration is called a Sprint.
MVP / MVCR / NVP		**Minimum Viable Product (MVP):** An early version of the software that has just enough working features to meet basic minimum functional capabilities and fill a user's need. The goal of an MVP is to quickly deliver basic capabilities into users' hands for evaluation, feedback, and improvements. **Minimum Viable Capability Release (MVCR):** as used in DoD software policy, a set of features suitable to be delivered to an operational environment. It provides value and capability on a reduced delivery timeline. The MVCR is analogous to a Minimum Marketable Product (MMP) in commercial industry. **Next Viable Product (NVP):** The next set of features in the succeeding product delivery.

See glossary for terms and definitions used in PSM CID measurement framework

Measurement Context
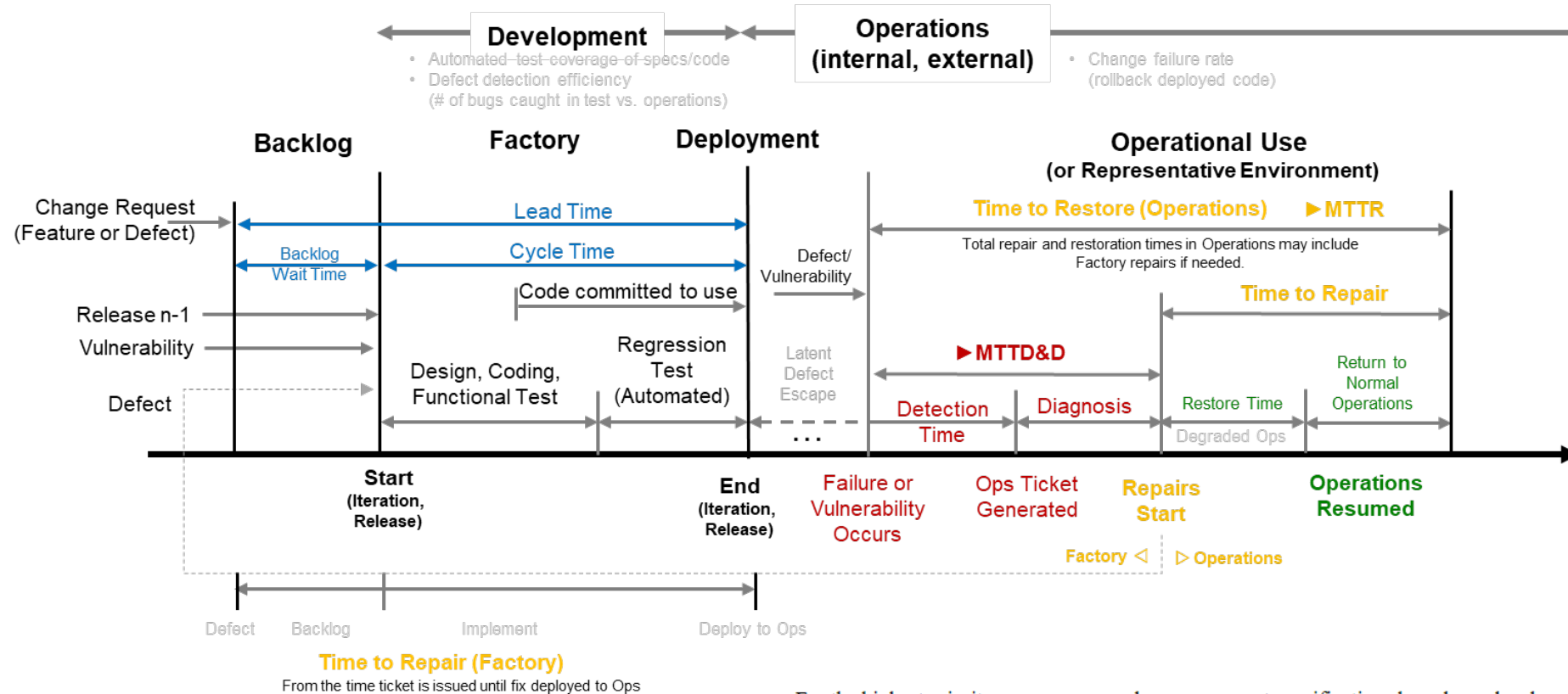
PSM Continuous Iterative Development (CID) Measurement Framework
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ICM Table (Excerpt)

7. ICM TABLE
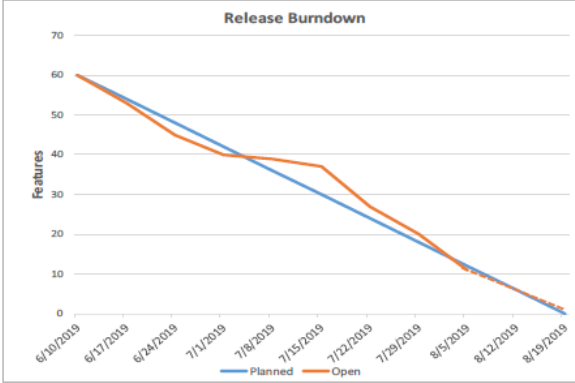
Table 5: Issues, Categories, and Measures

Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need	Potential Measures
Schedule and Progress	Work Unit Progress (team, product) Milestone Completion (enterprise)	Are story points delivered as committed? Are we still on track to deliver all story points per roadmap? (on plan)	Are features/capabilities delivered as committed? Are we still on track to deliver all features/capabilities per roadmap? (on plan) What are the features/capabilities at risk of not being completed as scheduled?	Are capabilities delivered as committed? Are we still on track to deliver all capabilities per roadmap? (on plan) What are the capabilities at risk of not being completed as scheduled?	Burndown Committed vs. Completed Velocity
	Work Unit Progress		Did we deliver expected capabilities / features? Is the roadmap still valid?	Is the user satisfied with the delivered products? Do they provide the desired functionality when needed?	Feature or Capability Implementation
	Work Unit Progress		Is the integration and test progress proceeding as planned?		Test Progress
	Work Backlog		How much outstanding technical or mission debt exists?		Cumulative Flow Feature or Capability Backlog

Example PSM CID Measurement Spec

- Description
- Relevant Terminology
- Information Need
- Base Measures
- Derived Measures

- Indicator Description and Sample
- Analysis Model
- Decision Criteria
- Additional Analysis Guidance
- Implementation Considerations

- Information Category
- Measurable Concept
- Relevant Entities
- Attributes
- Data Collection Procedure
- Data Analysis Procedures

Example PSM CID Measurement Indicators

Team, Product, or Enterprise Measures

Automated Test Coverage
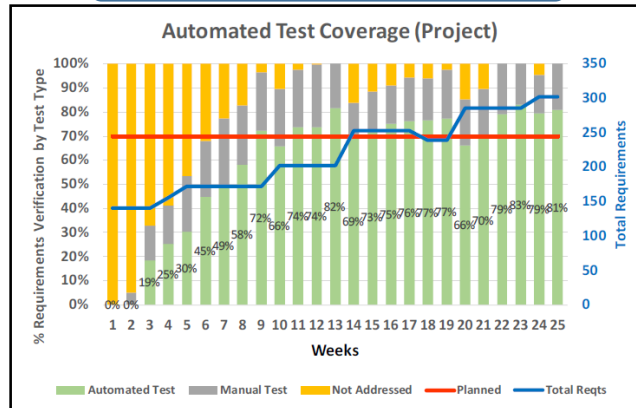
Figure 9: Automated Test Coverage (Project Level)

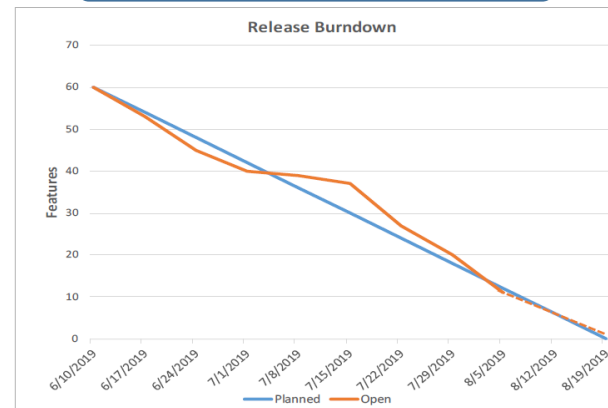## Burndown

Figure 13: Release Burndown
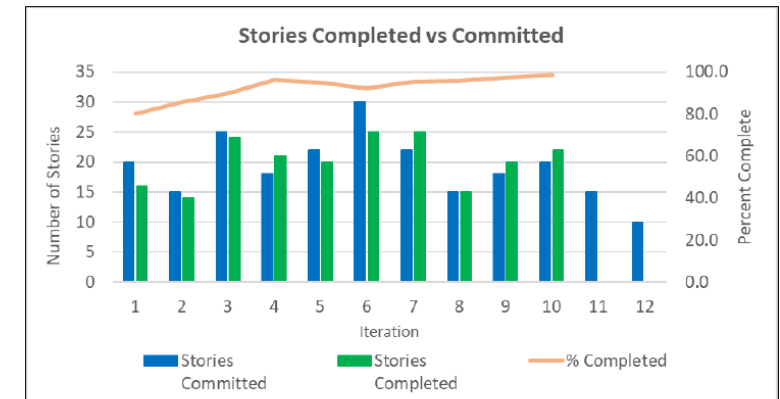
Committed vs. Complete

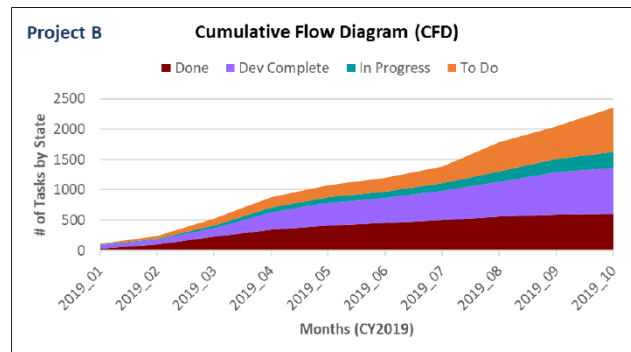Figure 14: Stories Completed versus Committed

Cumulative Flow

Figure 16: Cumulative Flow Diagram
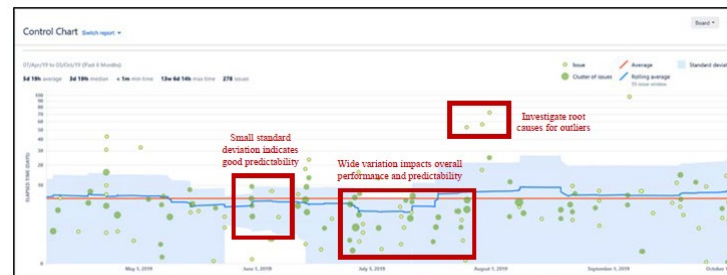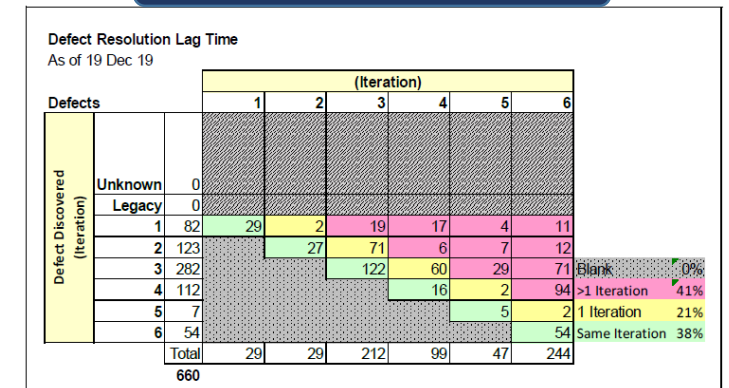
Cycle Time / Lead Time

Figure 19: JIRA Control Chart focusing on an area of interest

Defect Detection

Example PSM CID Measurement Indicators

Team, Product, or Enterprise Measures

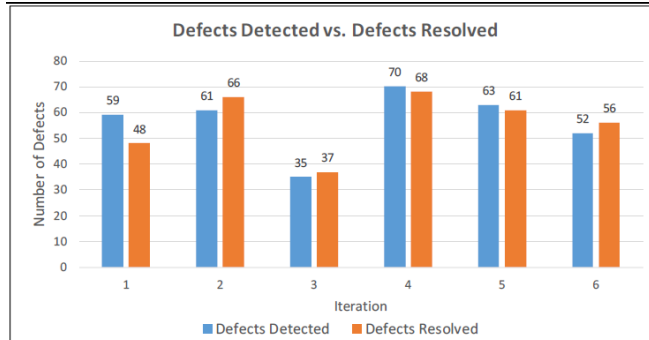## Defect Resolution

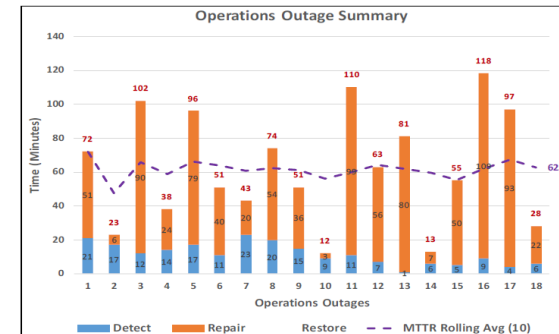Figure 21: Defects Detected versus Resolved

MTTD / MTTR

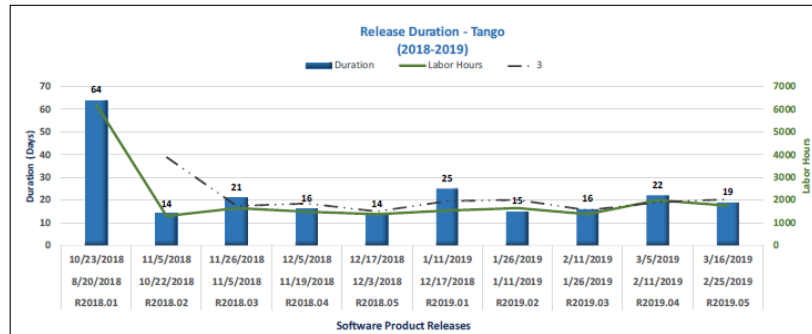Figure 24: Operations Outage Summary

Release Frequency

Figure 27: Release Duration for Product Tango
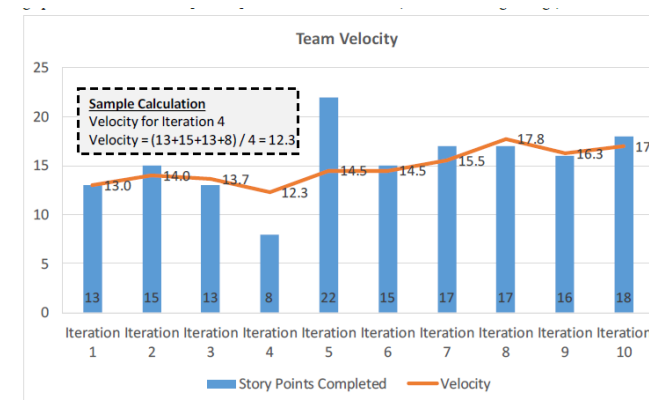
Team Velocity

Figure 29: Team Velocity

Next Steps

☑ **Publish PSM v1.0 CID measurement framework**

- Collect community feedback. Publish source specs for org tailoring. Support adoption and use.

Consider additional Phase 2 measures to address highest priority business needs

- Value assessment. Size/cost estimating. Security.
- Additional focus on enterprise-level and end user information needs and measures.
- Workshop kickoff: Feb 12-13, 2020   (Lockheed Martin Global Vision Center, Arlington VA)
  (POC: Cheryl Jones, cheryl.l.jones128.civ@mail.mil)

Ongoing community participation to improve the PSM CID framework

- Join the PSM/INCOSE/NDIA WG (bi-weekly teleconferences)
- Outreach and engagement with stakeholder groups (e.g., Security WGs)

PSM User's Group and Workshop, Aug 10-14, 2020