



Acquisition Research Program:
Creating Synergy for Informed Change

DoD Software Intensive Systems Development: A Hit and Miss Process

Brad R. Naegle

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE MAY 2015		2. REPORT TYPE		3. DATES COVERED 00-00-2015 to 00-00-2015	
4. TITLE AND SUBTITLE DoD Software Intensive Systems Development: A Hit and Miss Process				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School, Monterey, CA, 93943				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the 12th Annual Acquisition Research Symposium held May 13-14, 2015 in Monterey, CA.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 11	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Software-Intensive System Development

Hits

- Tomahawk Missile
- Aegis
- Link 16
- F-22 Raptor

Misses

- Future Combat System
- B1 Bomber
- P8 Poseidon MMA
- F-35 Joint Strike Fighter



The Problem

- The Defense Acquisition System produces both successful and challenged software-intensive systems

The Symptoms

- Development cost & schedule hyperinflation
- Systems fielded with less capability than desired
- Operational capability delayed years
- Costly and difficult software sustainment



The Underlying Causes

- The DoD Requirements Generation System
 - Requires interpretation between Capabilities-Based terms (JCIDS) and Performance-Based terms (Performance Spec), and again to Detailed Specification
 - ***Purposely vague to garner maximum innovation***
 - ***Dependent on the developer to correctly interpret and propose innovative solutions***
 - ***Provides only a glimpse at the operational environment through the Operational Mode Summary/Mission Profile***
 - Information Assurance/Cyber Security needs



Causes Continued

- Immature Software Engineering Environment
 - No industry-wide standards, protocols, formats, architectures, tools, or languages
 - No sustainability standards or architectures
 - Very limited capability for reuse
 - ***Totally dependent on clear, unambiguous, and complete requirements*** (Half or more of the software development effort occurs before PDR)
 - Requirements creep and late definition disastrous to the effort



Causes Continued

- The Defense Acquisition System
 - Pressure to reduce cycle time can impact front-end processes (*'Get RFP on the street!'*)
 - No consistent methodologies for driving software architecture or sustainability design
 - Information Assurance/Cyber Security needs drives developers to typically build software from scratch
 - Software TRLs ineffective at reducing development risk
 - Contractor is assessed for risk (CMMI), but PM team has no 'maturity' requirements



Attacking the Causes

- Implementation of analyses, tools, and processes
 - SEI's Quality Attribute Workshop (QAW)
 - A more complete inventory of requirements
 - MUIRS Analysis
 - Analyses for sustainability and safety/security needs
 - SEI's Architectural Trade-off Analysis Methodology sm
 - Clarifies context and drives architectural design
 - Connects user needs to system design to test program
 - FMECA
 - Identifies critical and non-critical system attributes
 - SEI's Software Acquisition (SA)-CMM
 - Assesses the Government's PM team maturity



ATAM
Input

Scenario Development

Test Case Development

Use Cases

-Performance

- MUIRS

Growth Scenarios

-Performance

-MUIRS

Exploratory Scenarios

-Performance

-FMECA

-MUIRS

Integrated
into test
program

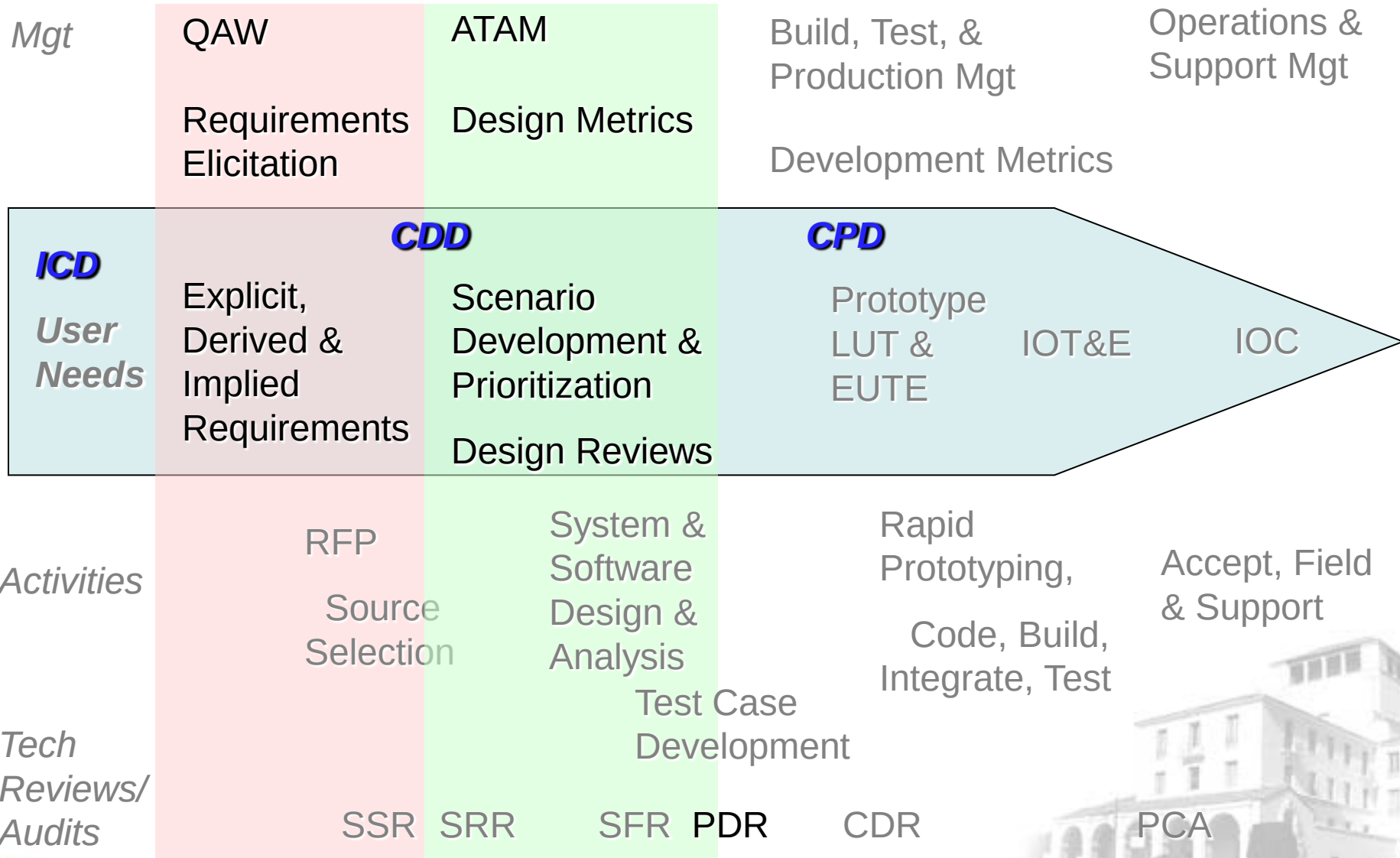
User
Need

QAW

CDD



QAW & ATAM Integration into SW Lifecycle Management



SA-CMM

Level	Focus	Key Process Areas
5	Optimizing	Continuous process improvement, Acquisition Innovation Management, Continuous Process Improvement
4	Quantitative	Quantitative management, Quantitative Acquisition Management, Quantitative Process Management
3	<i>Defined</i>	<i>Process standardization, Training Program Management Acquisition Risk Management, Contract Performance Management, Project Performance Management User Requirements, Process Definition and Maintenance</i>
2	Repeatable	Basic project management, Transition to Support Evaluation, Contract Tracking and Oversight, Project Management, Requirements Development and Management, Solicitation, Software Acquisition Planning
1	Initial	Competent people and heroics



Summary

- Using these tools, analyses, and processes will help address the **causes** of software development problems.
- The PM team must mature beyond 'Competent People and Heroics' to manage the complex software development challenge
- A mature PM team effectively implementing the tools, analyses, and Processes will result in more consistently successful software-intensive systems development

