



Finding the 'RITE' Acquisition Environment for Navy C2 Software

12th Annual Acquisition Research Symposium

Panel #15

In Pursuit of Agile Software Development and Testing

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Rapid Integration and Test Environment

A fundamental change in the way C4ISR software is acquired....

- ▼ Commercial best-practice software engineering standards & processes
- ▼ Explicit governance and contractual guidance
- ▼ Automated testing and report generation tools
- ▼ Enables Agile Development and Rapid Fielding

Provided via a Government-run development and test facility

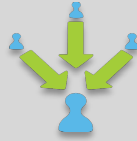
RITE Benefits	
INCREASES	DECREASES
Software Quality	Development Cost
System Reliability	Sustainment Cost
System Security	Time to Field
Engineering Productivity	Program Risk

RITE's History

- ▼ RITE was initiated over 7 years ago as a response to program of record challenges in managing, producing and fielding C2 software
- ▼ Evolution of commercial best practices in agile development tailored to work within the DoD acquisition structure
- ▼ Key Enabler of Rapid IT acquisition programs
- ▼ RITE being leveraged by 16 software programs



RITE's Four Pillars



Contracts

- Boiler plate contract language - Gov purpose Rights
- Adding expectation of quality to contracting language
- Template SOW's created

Processes

- Integrates continuous testing into Development stage
- Institutionalize source code analysis
- Automates and focuses testing
- Standardizes tools and test cases

Infrastructure

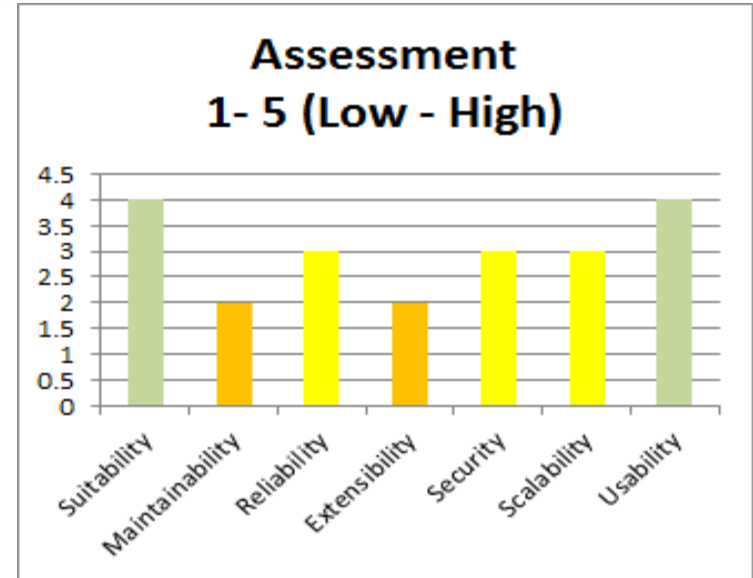
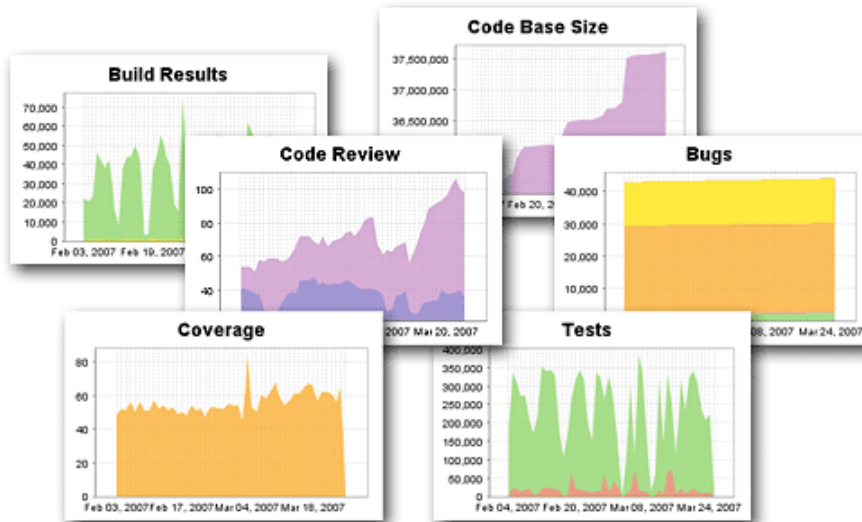
- Centralized Repository
- Enhances project comms and collaboration
- Sharable Software Testing tools and data

Organization

- Transformation of workforce
- Software intensive training
- Government able to respond more quickly and with authority

Source Code Management

Providing Visibility Into Production Process



Leveraging Automation

- *Static Code Analysis*
- *Quality Code Review*
- *Code Complexity*
- *Compliance checks*
- *Automated Regression Tests*
- *Error Tracking*
- *Centralized Monitoring*

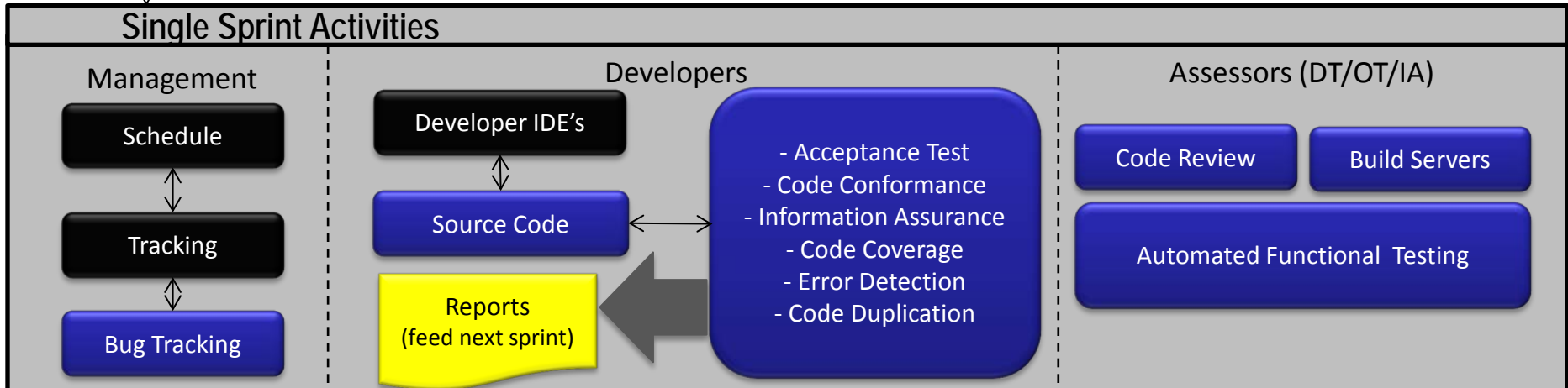
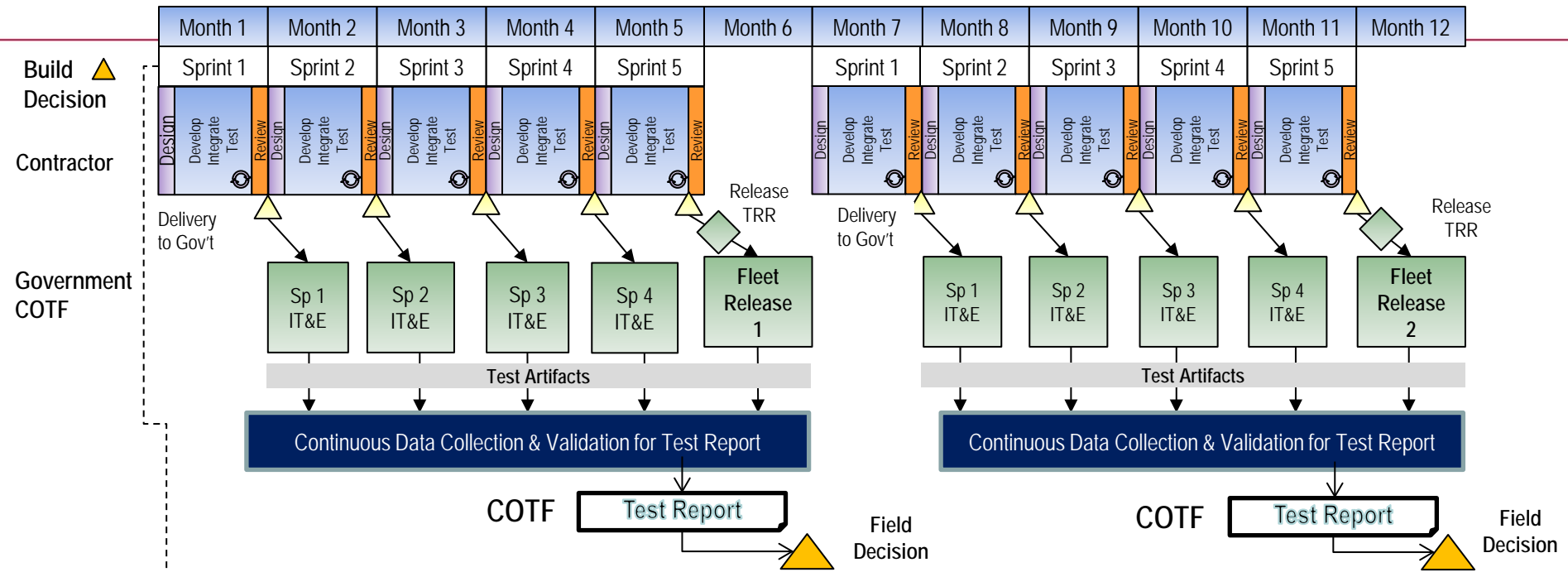
Subject Matter Expertise

- *Program Assessment Reports*
- *Software Quality Assessment*
- *System Quality Assessment*
- *Engineering Recommendations*

Application of RITE



Rapid IT Process & RITE Process

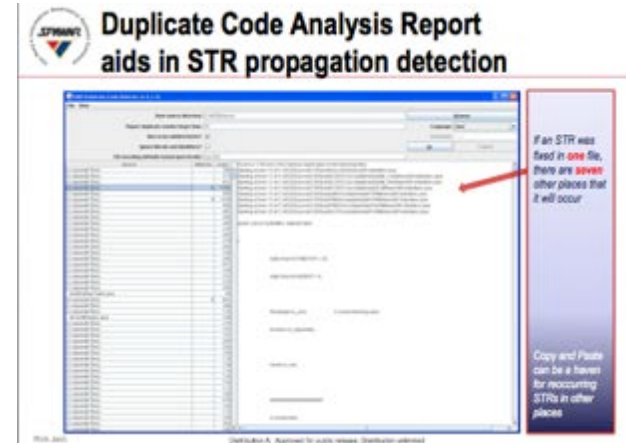


RITE program metrics



▼ RITE enables visibility of program using metrics

- Early address of critical issues
- Movement of critical resources to fix problem areas
- Determine quality and predict sustainment
- Ready access to health of program
- Mitigate high risk items sooner



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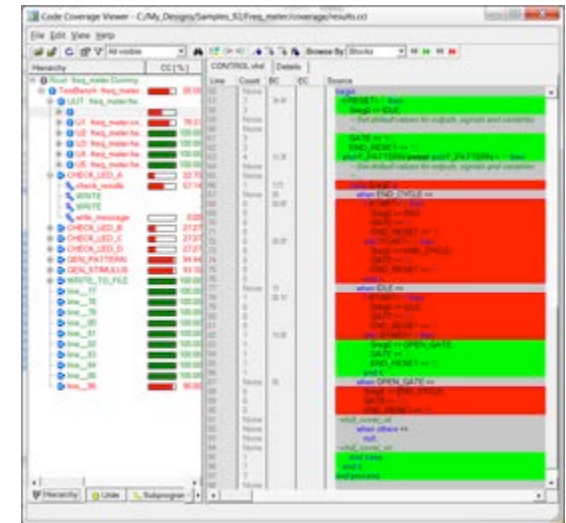
SW Quality Metrics: SP9
SLOC, Defects, Defect Density

SPACE AND MISSILE SYSTEMS CENTER

Sprint	Coupling Cohesion										# unused code violations										%unused code									
	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
JMS	0	0	1	1	1	1	1	1	1	0	0	0	274	274	274	274	274	274	274	274	0.0000	0.0000	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005
UDCR	0	0	1	1	1	1	1	1	1	0	0	0	1867	1806	1806	1891	1891	1891	1891	1891	0.0000	0.0000	0.0028	0.0028	0.0028	0.0029	0.0029	0.0029	0.0029	0.0029
ASW	0	0	1	1	1	1	1	1	1	0	415	415	408	508	508	515	515	515	515	515	0.0004	0.0006	0.0006	0.0007	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
CS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0	0	1	1	1	1	1	1	1	0	415	415	2854	2857	2857	2745	2896	2896	2896	2896	0.0001	0.0002	0.0012	0.0012	0.0014	0.0014	0.0014	0.0016	0.0016	0.0016

Sprint	# Software Complexity Violation										Software Complexity Density									
	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
JMS	795	774	650	650	650	580	580	580	580	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	
UDCR	1545	2571	2565	2558	2738	2747	2571	2571	2571	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	
ASW	3201	4871	4891	4921	3731	3731	3554	3554	3554	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
CS1	181	181	181	181	181	181	181	181	181	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	
Total	4462	4438	3683	3683	3737	3768	3602	3602	3602	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	

Legend	Below or Equal to Objective	Objective and < Threshold	> Objective and > Threshold
# Defect	1 per 100 SLOC	1 per 100 - 200 SLOC	Greater than 1 per 200 SLOC
Defect Density	< 0.3%	0.33% - 0.5%	> 0.5%
# Defects Removed	> 90%	80-90%	< 80%
DRR	> 90%	80-90%	< 80%
Coupling	< 2.2	2.2 - 3	> 3
Unused Code Violation	1 per 100 SLOC	2 per 100 SLOC	3 per 100 SLOC
% Unused Code	< 1%	1-2%	> 2%
Complexity	1 per K/SLOC	1.5 per K/SLOC	3 per K/SLOC
Complexity Density	< 0.30%	0.30 - 0.40%	> 0.40%



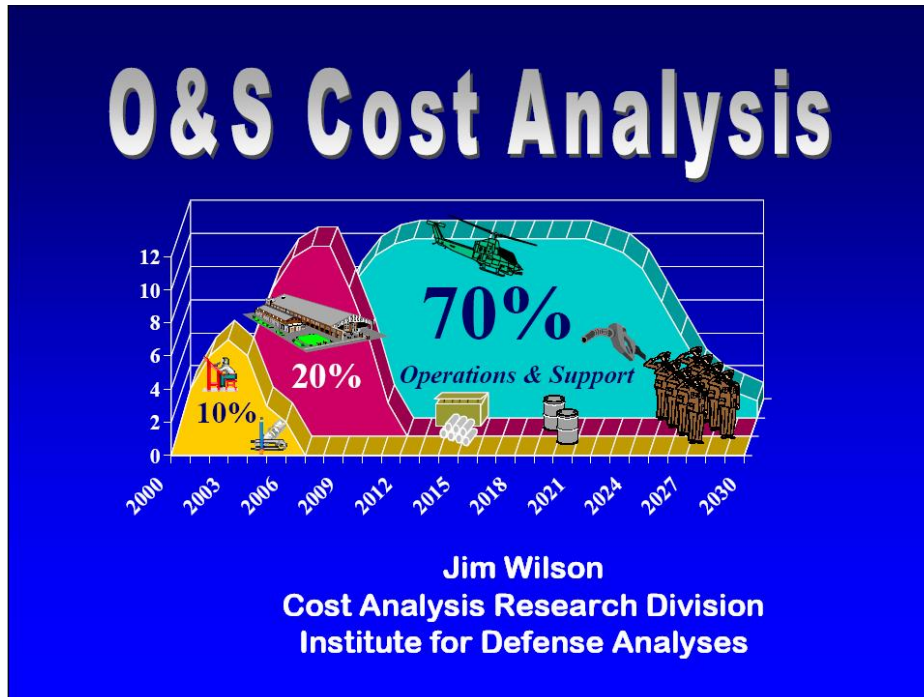
RITE Tool Suite (Evolutionary)

Tool	Type Tool	Measure	Category
Wiki	Agile Development Collaboration	Allows for sharing of artifacts, communication of development team	Management & Developer
JIRA	Agile Issue Tracker	Workflow and Issue tracker to conduct sprints. Plugins used to define workflow and Agile Method	
Subversion	Source Code Repository	Software Repository for Source Code Management	
Lattix	Dependency Analysis	Modularity and Complexity	Static Source Code Quality
FindBugs	Static Analysis	Defects in Java code	
PMD	Static Analysis	Programming flaws in Java, JavaScript, XML, and XSL. Cut and Paste Detector for C, C#, PHP, Python	
Klocwork	Static Analysis	C, C#, .NET Code refactoring and reliability	
Coverity	Static Analysis	Defects in C, C#, .NET and Security	
Atomiq	Static Analysis	Duplicate Code for Security/IA	
Rational Purify Suite	Dynamic Analysis	RunTime Debugger	
MCCABE IQ	Static Analysis	Cyclomatic Complexity and KSLOC. All Languages	
HP Fortify	Security Scan	STIG and Vulnerabilities	Security & IA
GSSAT (GOTS)	Security Scan	STIG and Vulnerabilities	
AutoIT	Automated Test	Scripting Engine for Automation	Functional Testing
TestComplete	Automated Test	Automation Orchestration Suite	
ATRT	Automated Test	Interface Testing and Data Producer	

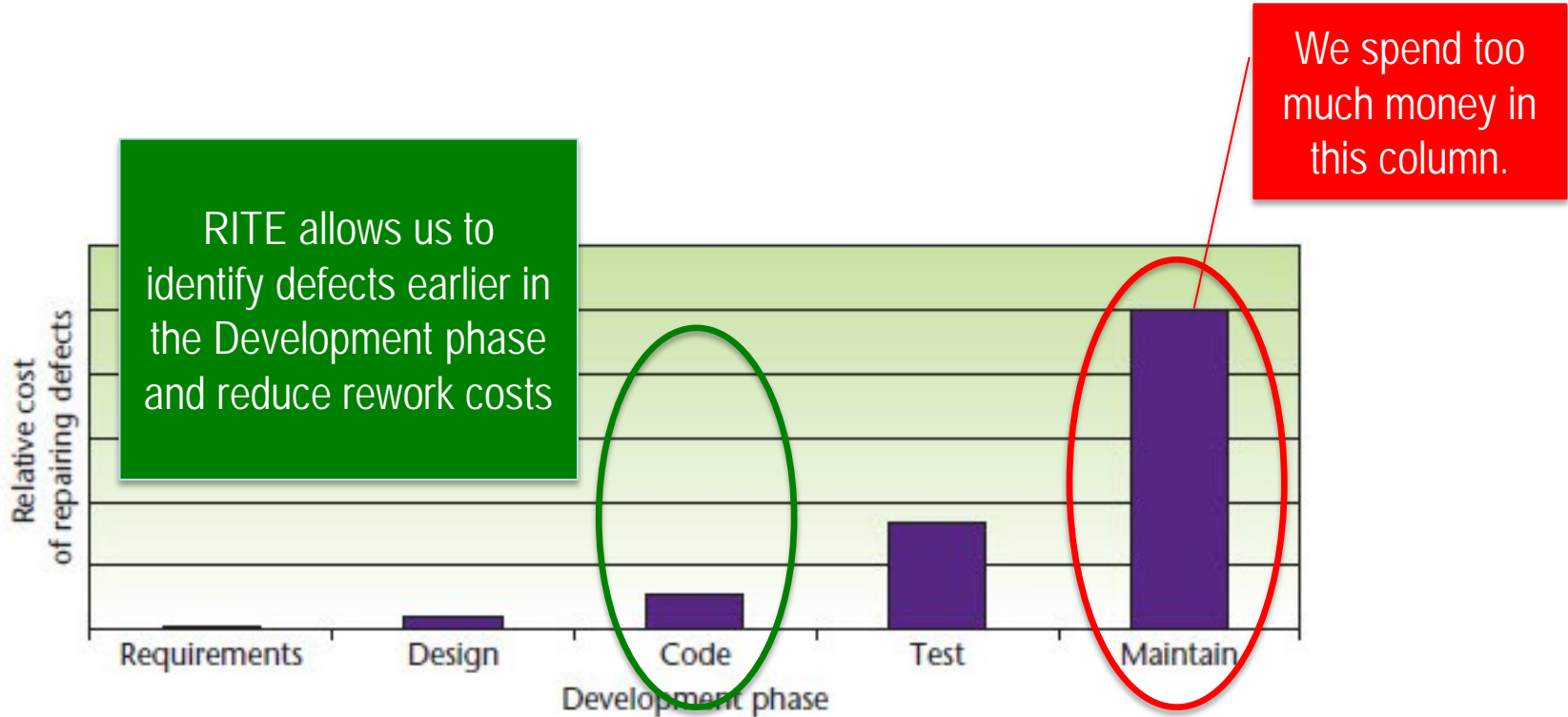
RITE enables Critical Bug Finds



- ▼ Early software assessments and automated testing provided for Identification of over 100 “Critical” Software bugs up to 8 months earlier than expected
 - Detection during development integration cycle vs Major Development Test



RITE Benefit



Today...

Storefront/Tactical Marketplace

▼ Storefront Benefits:

- **Speed to Capability:** Enables rapid fielding of capabilities to the warfighter by automating the distribution, updating, and installation of components
- **Simplified User Experience:** Provides a common presentation, distribution, update, and installation service for all PoRs
- **Driving Down Cost:** Reduces fielding and deployment costs

Storefront/Tactical Marketplace Initiatives

- ▼ SSC-PAC is establishing a Navy App Store ecosystem (systems, processes, guidance, etc.) to enable accelerated fielding of new capabilities to the warfighter at the tactical edge
- ▼ SSC-PAC has an open dialogue across the DoD Storefront stakeholders:
 - DoD policy working group aligning the Widget technologies across the enterprise (DoD Widget Working Group)
 - Member of the Ozone Widget Government Open Source Software (OWF GOSS)
 - Technical Exchange Meetings with other Storefront efforts:
 - JC2CUI - DISA PEO C2C / GCCS-J Application Store, DI2E Storefront, PEO C4I Storefront

Notional OV-1 Tactical Storefront

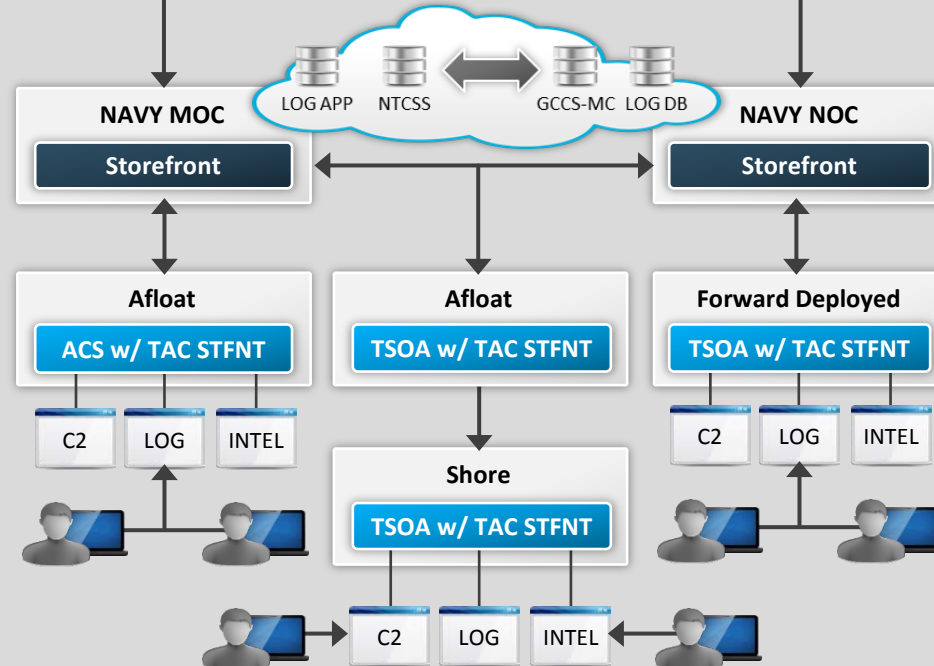
Agile Development



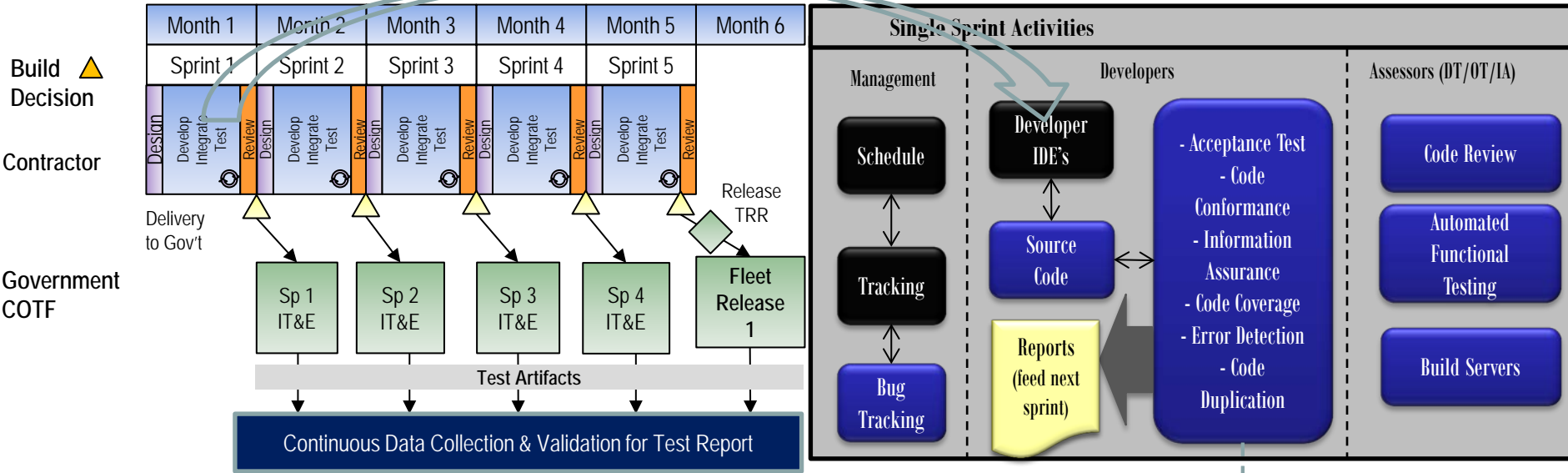
Test & Approval



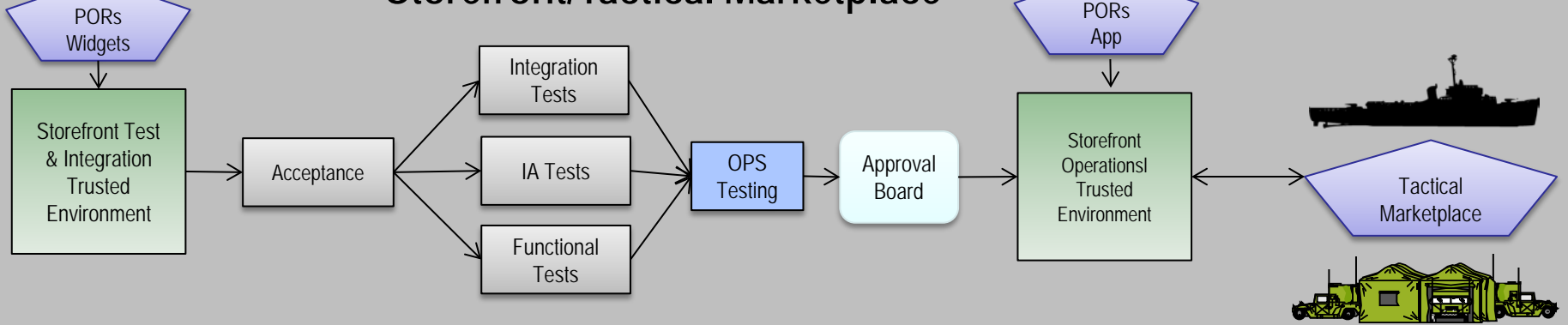
Ashore & Tactical Storefront



Rapid IT & RITE Process Using Storefront/Tactical Marketplace



Storefront/Tactical Marketplace



Summary

- ▼ Program visibility into production
- ▼ Rapid IT and RITE process alignment
- ▼ Metrics to drive quality
- ▼ Better productivity
- ▼ Tools to assess risk and quality
- ▼ Cost savings

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Questions?

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