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Total Ownership Cost a Decade Into the 21st Century

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Acquisition Research Program: Creating Synergy for Informed Change



Total Ownership Cost – A Decade into the 21st Century

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Total Ownership Cost—a Decade into the 21st Century

2003 – Where We Were

- Positive
 - Encouraged experimentation
 - Come up with new approaches
- Negative
 - Leadership wasn't heavily involved in affordability – not speaking with one voice
 - Lack of Discipline (e.g., technological maturity)
 - Lacked risk assessment tools (TRLs, MRLs, SMLs)



Total Ownership Cost—a Decade into the 21st Century

Today – Where We Are

- Cost estimating
 - Certifications
 - Nunn-McCurdy
 - Cost Databases
 - Affordability Slices of Mission Areas
- Collaborative IT
- Mandated reviews – MS B (KP-1), CDR-A (KP-2), MS C (KP-3)
- Navy Gate Reviews (affordability)
- Configuration Steering Boards (counter to requirements creep)
- Product Support Manager – Performance Based Logistics (affordable logistics)



Total Ownership Cost—a Decade into the 21st Century

Opportunities

- Cost estimating impediments
 - Statistical **Confidence Levels**
 - Useful **Cost Databases** – support **early** cost estimates?
 - **Nunn-McCurdy** Breaches using the **wrong metrics**
 - Cost vs. **Affordability**
- Collaborative IT
 - Are the **right stakeholders involved** in the conversation?



Total Ownership Cost—a Decade into the 21st Century

Summary

- Mandated discipline
- Bureaucracy
- Selective lack of tools
- Need to move to self-motivated discipline



Software Intensive Systems & TOC

- Poor SW size & complexity estimates lead to understated SW O&S cost estimates
 - Requirements progression from user 'Capability Need' through PM 'Performance Spec' to contractor 'System Design' invites requirements interpretation
 - Interpretation leads to vague or missed requirements
 - Vague/missing requirements lead to poor SW size & complexity estimates
-
- Repeat as necessary!



Bridging the SW Requirements Gap

- The immature SW engineering environment is incapable of satisfying unstated requirements – especially supportability performance gaps
- Requirements gap analysis essential for attaining SW supportability performance – **MUIRS Analysis:** Maintainability, Upgradability, Interoperability, Reliability, Safety & Security
- **Goal:** Develop complete, well defined inventory of requirements, including stated, derived, and implied
- **Tools:** MUIRS Analysis & SEI's Quality Attribute Workshop (QAW)



SW Design – The Key to O&S Performance

- Must drive the design for supportability performance
- Starts with a complete inventory of requirements, including supportability requirements resulting from a Logistics Supportability Analysis – **MUIRS**
- SW developer needs to know requirements in context – How will system be used & maintained? In what environments? What is the priority of essential functions & enhancing functions? How should it operate when stressed? What is the expected exception handling, fault tolerance, and recovery techniques? How will performance be verified?



SW Design continued

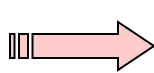
- User involvement in the SW design process is critical – they must develop scenarios for:
 - Use Cases: Including MUIRS focus for supportability
 - Growth: Anticipated changes over the life cycle
 - Exploratory: Expected performance when stressed, including FMECA prioritization of functionality/recovery
- Goal: Ensure SW developer understands warfighter expectations **before** system is designed
- Tools: SEI's Architectural Tradeoff Analysis Methodology (ATAMsm)



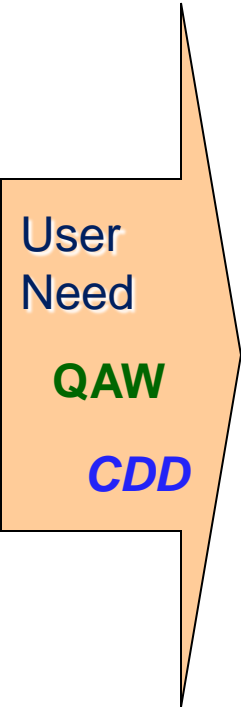
**ATAM
Input**



Scenario Development



Test Case Development



Use Cases

-Performance

- MUIRS

Growth Scenarios

-Performance

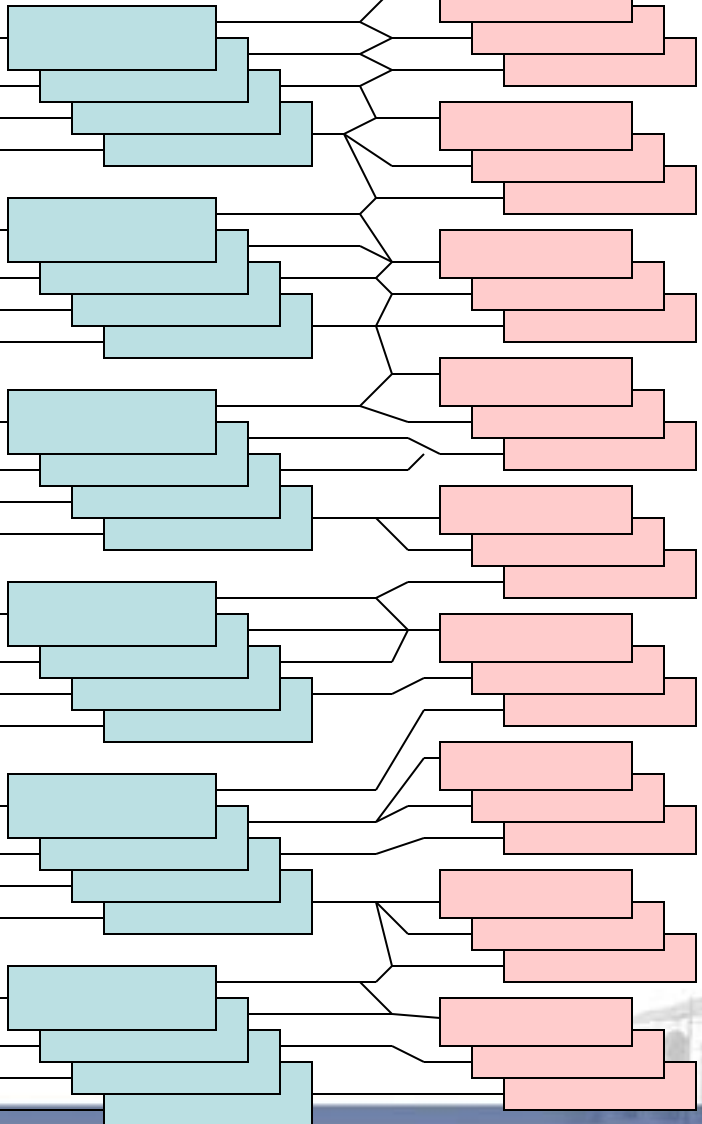
-MUIRS

Exploratory Scenarios

-Performance

-FMECA

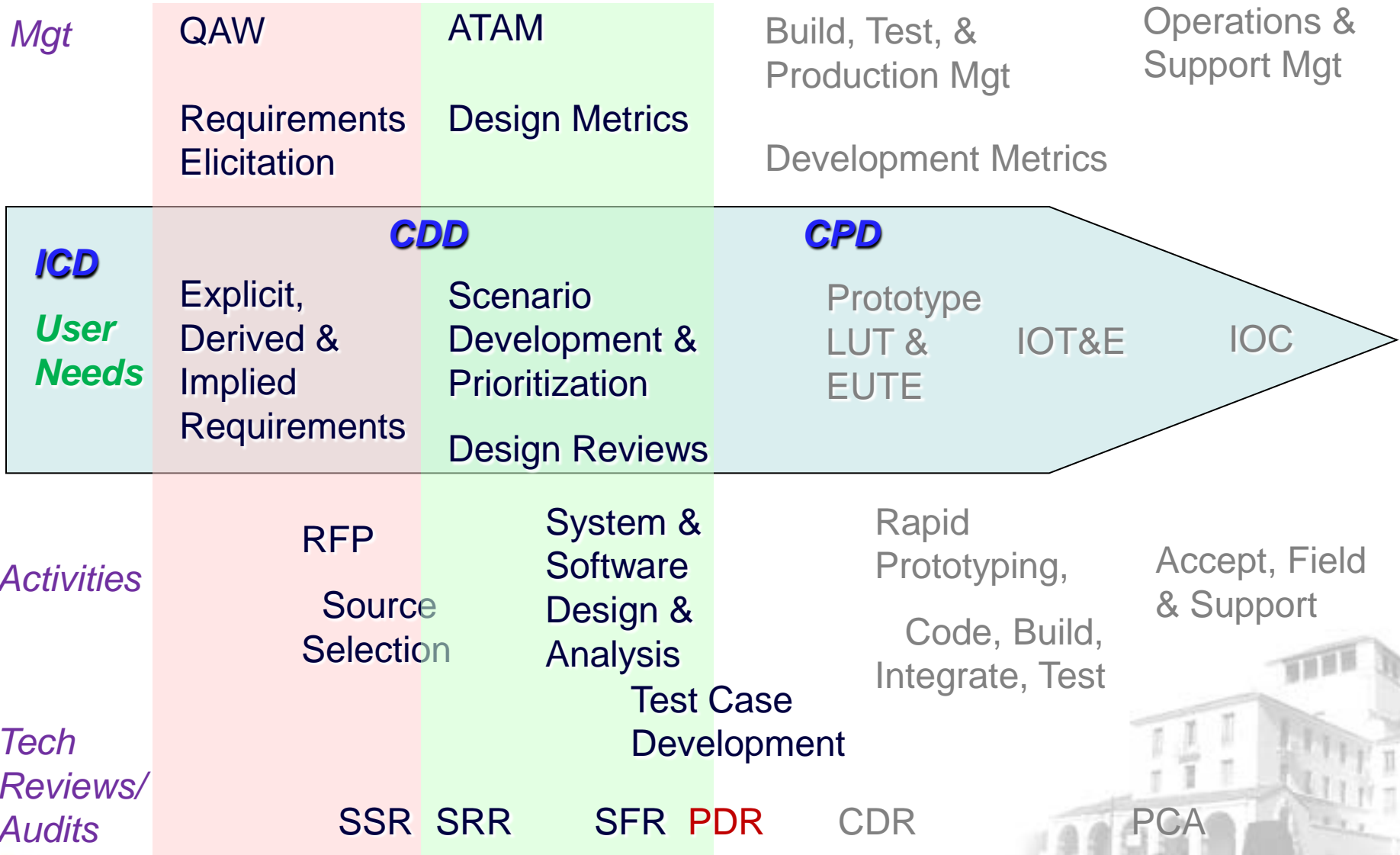
-MUIRS



**Integrated
into test
program**



QAW & ATAM Integration into SW Lifecycle Management



Summary: Improving SW TOC Performance

- Break the cycle: Poor requirements/designs = difficult and costly SW sustainment
- Complete the inventory of derived and implied SW supportability requirements with MUIRS analysis
 - Tools: MUIRS Analysis technique and SEI's QAW
- Drive the system design for improved supportability performance, critical for Software
 - Tool: SEI's ATAM sm
- Ensure test program includes supportability performance testing, stress testing, fault handling, and recovery techniques
 - Tool: SEI's ATAM sm

