

Requirements Verification: How much Confidence can You Afford ?

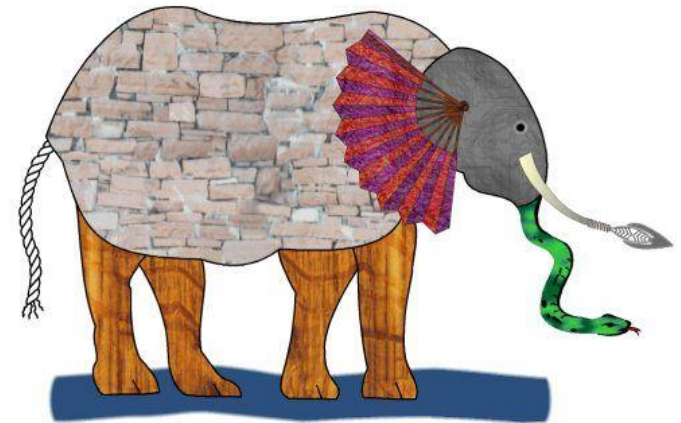
**Chesapeake INCOSE Chapter meeting
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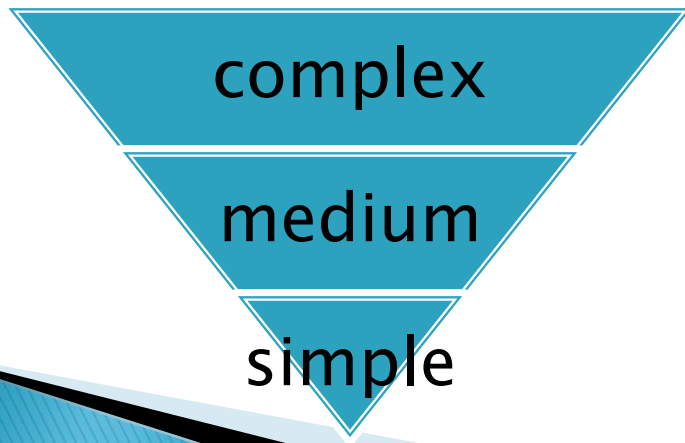
Agenda

- ▶ Introduction
- ▶ Real Examples
- ▶ Test Focus
- ▶ Modern Approaches & Strategies
- ▶ New Trends
- ▶ Emerging Trends for Requirements Verification
- ▶ Summary



Introduction

- ▶ Confidence per Dollars– Requirements
- ▶ Prioritization & Risk– Risk ties to Confidence
- ▶ Synergy & Test Events
- ▶ 80/20 rule & All Requirements not equal
- ▶ Lean Six Sigma
- ▶ Tight Trace



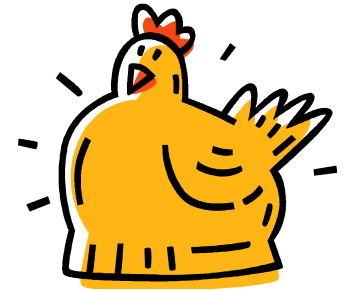
Real Case Study Examples (1 of 3)

- ▶ GMD –Processes not the Silver Bullet
- ▶ Requirements
 - Message Errors
 - User Requirements not Spec.
 - SOW Requirements not Spec.
- ▶ Requirement 10 % better than the previous System
- ▶ Trace
- ▶ Training Verification Process
- ▶ Method Definition
- ▶ TBDs
- ▶ Test Events



Real Case Study Examples (2 of 3)

- ▶ 5 Dimensional Interrelated Requirements
- ▶ Test Events Objectives & Priorities
- ▶ Configuration Management
- ▶ Chicken Test
- ▶ Verify NASA
- ▶ NVG NVEOL
- ▶ Hundreds of Children and Grandchildren Problems
- ▶ Confuse Verification with closely related areas like Validation, Assessment, and Test



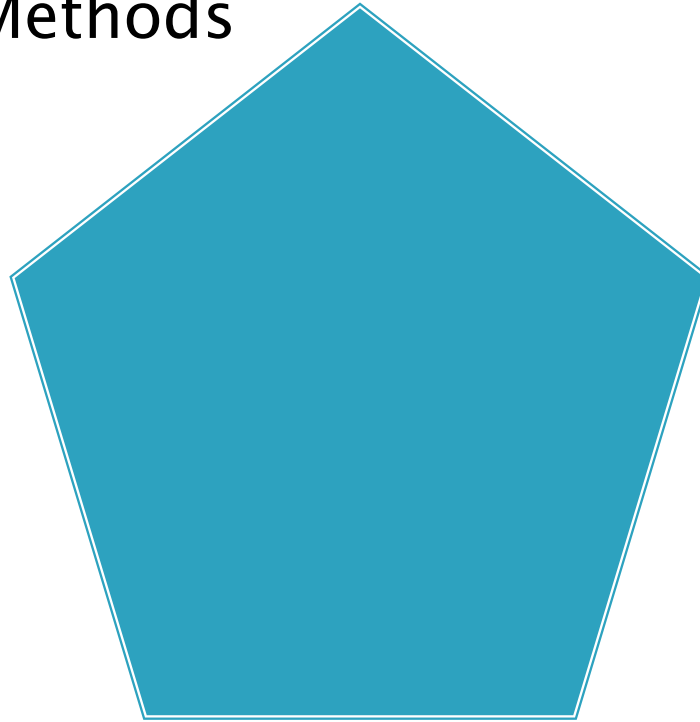
Real Case Study Examples (3 of 3)

- ▶ Tight Trace using Requirements Tools
- ▶ Assessment & Verification in the same Team
- ▶ Verification more than just exceeding Hurdle / Boundary Testing and Analysis / Partitioning
- ▶ Back up Verification Events
- ▶ LIDS-early, other M&S, tie to Physics, Calibration, Parallel Computers
- ▶ DOE & Bayesian Statistics
- ▶ Plan flexibility for likely changes
- ▶ Kuwait/War fighter



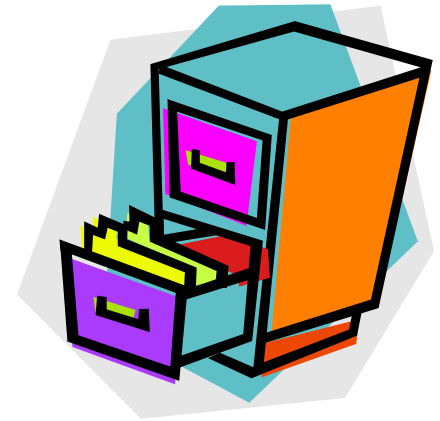
What Real Requirement Written vs. Data Needs ?

Sides of the Pentagon are Fuzzy Parameters:
Confidence, Conditions, Related Requirements,
Tolerance, Methods



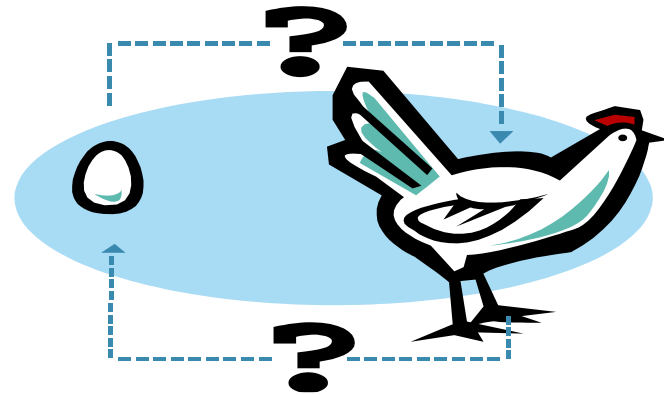
Planning

- ▶ Environment Tools–T&E, M&S, Inspection, CASE, & Database
- ▶ Confidence– Statistical, Realism
- ▶ Event Combining & Levels
- ▶ Multiple Methods & Method Choice
- ▶ Data Reuse and use of “Tight” Trace
- ▶ Definitions of Methods & Process
- ▶ Requirement Understanding/Context
- ▶ Envelope
- ▶ Regression/ Reverification/Redo

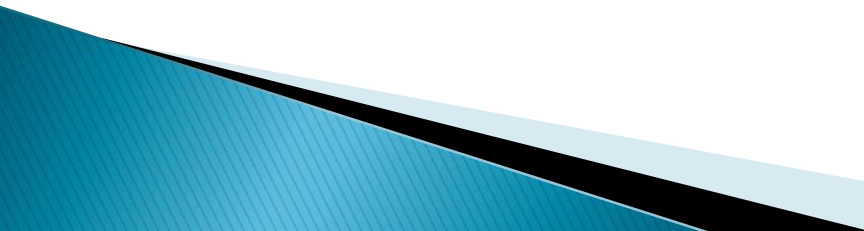


Lead -time Away

- ▶ Do we need a special Event, Tool, Process, Method in order to complete Verification as defined
- ▶ Negotiations the meaning of Requirement and Acceptable Confidence – for Cost, Schedule and Risk reasons
- ▶ Develop Verification with Requirement and Design per Level of Detail



Synergy Other Verification, SE, PM

- ▶ Other Types of Verification– Method, Planning, Coordinating Data & Events
 - ▶ Books include SW and Circuit Card verification
 - ▶ SE– Integration, Assessment, Risk, Priorities, TPMs
 - ▶ SE– Agile– Automated Regression Testing in Agile Environment by J.B Rajumar (3 Priorities Requirement, Script Development Phase)
 - ▶ SE– Analysis & Planning
 - ▶ PM– Lean Six Sigma, Assessment, Risk, PMP
 - ▶ PM– Schedule, Agile–Clarity of Acquisition Strategy
 - ▶ PM– Dollars to Fund Environment & Events
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Emerging Trends (1 of 3)

- ▶ 1. Re-certification Delta Testing
- ▶ 2. Simulations and Testing in Parallel with Design Cycle

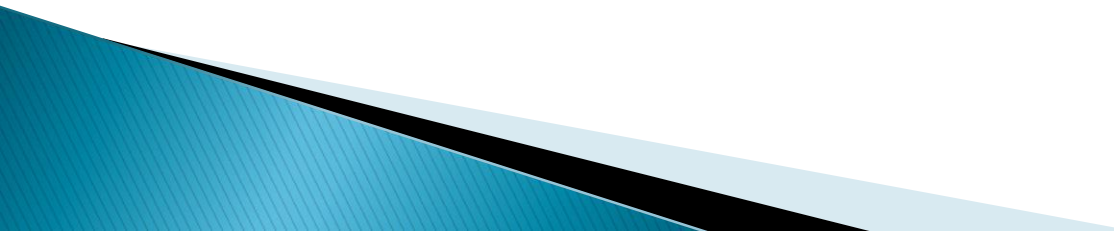


Trends (2 of 3)

- ▶ 3. Machine Sensor Inspection
- ▶ 4. Parallel Computer for M&S
- ▶ 5. Combining M&S & Calibration
- ▶ 6. Data Mining
- ▶ 7. Symbolic Model Checking– IBM Bryant, Clark, Emerson, McMillan– spec logic tree modeled in finite state transitions
- ▶ 8. Design for Testability / Inspect ability– Kenneth Crow DRM associates– Tolerance, manf. cap. Test points , BIT, ATE



Trends (3 of 3)

- ▶ 9. Verification using Requirements tool versus Verification tools
 - ▶ 10. Lean Six Sigma
 - ▶ 11. Test focus & automated testing
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Future

- ▶ CAD/CAM/Lean SE etc. fused
- ▶ Run overnight & or/lunch Computer potential new requirement to assess Verifiability and impacts
- ▶ Long term suggest unverifiable, needed environment and suggest how to rewrite req.
- ▶ Regression vs. risk
- ▶ Requirements Tools like DOORS or Req Combined with Other CASE tools
 - Suggested Method(s)
 - Better written (compose+)
- ▶ Long Term all CASE tools integrated

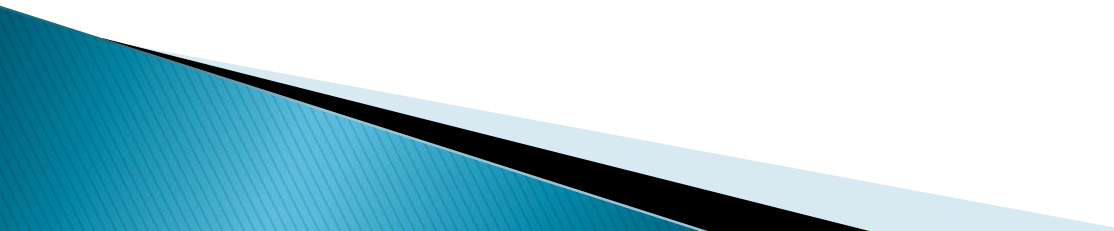


Summary

- ▶ We really supplying Confidence per Dollar– key real prioritization and tie to Risks
- ▶ Requirements Verification is Modernizing but pressures will continue to continue to do Cheaper, Faster, and Better
- ▶ Think outside the box we can do Requirements better and take advantage of Specialization, Other Domains, and Technology trends



Back ups



Definitions

- **Verification*** – confirm through the use of Objective Evidence that the specific Requirement has been met.
- ▶ **Validation*** – Assessing if the system meets what the user really needs.
- ▶ **Accreditation** – Approval of an authority of that the Models & Simulation is adequate for Intended Use.
- ▶ **Objective Evidence** – Factual Proof beyond a reasonable doubt or at least predominance of evidence.
- ▶ **Integration*** – Putting together and *lightly* verifying it works as planned.
- **Assessment*** – Assess ability and progress to meet Requirements with less than final configuration and / or Verification Environment.
- **Confidence** – Degree of comfort that it is proved the Requirement realistically
- ▶ **Types of Verification**
 - Requirements Verification
 - Software IV&V
 - Models & Simulation VV&A

* Use same methods

Re-Certification Delta Testing

- ▶ Regression approach applied to Certification
how much change is change how impacts
certification- little, middle, full

“Simulations and Testing in Parallel with Design Cycle”

- ▶ IBM Rational Testing Tools Sept 2009 Parsons & Leong

Boundary Testing



Previously Discussed

- Boundary Value Analysis– How good possible verify document more pass/ fail
- Partitioning– M&S models/ Physics, test

Business Models for Testing

- Testing Tools/Verification Environment
- Price it for Contribution
 - Verification
 - Risk Reduction / Assessment
 - Future Organizational Capability for Life-cycle
 - Marketing
- Impact on Schedule

