Affordable Test & Evaluation in a Complex World

27th Annual National Test & Evaluation Conference

“Test & Evaluation: Serving the Warfighter”

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Agenda

• Increasing System / Software Complexity

• Increasing T&E Costs or more Delivered Defects

• What can T&E do to be more Affordable
Increasing System / Software Complexity

• The environment of systems is ever an increasing complexity with more and more software
  – One engine manufacturer predicts that the cars and trucks of 2020 will have over a billion lines of code

• It appears that every new weapon system has more and more software

• Testing this much software is impossible with current methods
Increasing System / Software Complexity

Some Background

Last years NDIA T&E Conference presentation titled “Closing the T&E Gap…”

– “The funding and research for testing & evaluating new technologies is not keeping pace with the rate of technology change”
The Exponential Times We Live In

Current Rates

- New technology information doubles every 2 years.
- Adoption of technology is accelerating
  - To Reach 50 million users
    - Radio 38 years
    - TV 13 years
    - Internet 4 years
    - IPOD 3 years
    - Face Book 2 years

Predictions

- By 2013, a super computer exceeds capability of human brain
- By 2049 $1000 computer exceeds the capability of the entire human species.

This data is from the “Did You Know” series
The Information Revolution

Compute capacity continues to grow
Hardware limitations no longer constrains the software
Where is Connectedness Headed?

Semantic Web
Connects Knowledge

Ontologies
Knowledge Bases
Knowledge Management

Search Engines
Enterprise Portals
Web sites

The Web
Connects Information

Databases
“Push” Pub-Sub

File Servers
P2P File-sharing

The Metaweb
Connects Intelligence

Knowledge Networks
Enterprise Minds
Lifelogs
Semantic Weblogs

The Global Brain
Smart Marketplaces
Decentralized Communities

Social Software
Connects People

Marketplaces
Wikis
Community Portals

E-mail
USENET
Social Networks

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Diminishing Constraints

- Old paradigm of testing no longer effective

- Diminishing hardware constraints
- Increasing software complexity

- Relays to Vacuum Tubes 1930-1950
- Transistors to Microprocessors 1950-1970
- Computers to Internet 1970-1990
- Mobil to Hybrid Devices 2000-2010
- The future

Merging of Biology, Nanotechnology and Artificial Intelligent
Increasing T&E costs or more delivered Defects

• The cost of T&E for these very complex systems is increasing significantly when there is a real attempt to detect defects before delivery.

• My observation is that the following is occurring:
  – Some test automation is attempted with marginal success.
  – Test times are not generally being increased so less test coverage of functionality is actually occurring.
  – Results: more (complex) defects are being delivered.

• Constant pressure to reduce T&E cost & schedule.
Test Technology & Research Funding Gaps

What about the Technology Readiness Level Process?

What about T&E S&T and Corporate IRAD projects?

Bottom Line: T&E is not able to keep up with Technology
A Question

• Is all this complexity necessary?
  – Absolutely, it makes the Warfighters more effective, efficient and safer

• So what can we do as Test and Evaluation engineers?
T&E must become more Effective and Affordable

- Need more T&E Research in Government, Industry and Academia
  - Ensure Research is coordinated whenever possible (i.e. between Services, initiated / coordinated by Government, etc)

- Review the Technical Readiness Level processes to see if possible to add official T&E deliverables with TRL’s at specific levels, especially in the range of TRL 4 & 5.
T&E must become more Effective and Affordable

• Much more automation should be in use today
  – Training and investment must be done and this will have a big return on investment

• Ensure the use of Scientific (or Analytical) Test Design methods and tools

• Ensure T&E is actively involved with the research and related activities in the Model-Based Development/Engineering arena
Thomas L Wissinks Biography

Tom Wissink is the Lockheed Martin Corporate Engineering & Technology Director of Integration, Test & Evaluation and a Corporate Senior Fellow. He has worked in system/software integration and test, software development, configuration management, and several levels of management for more than 35 years, 30 of them with Lockheed Martin. He has worked on programs like the Space Shuttle and several Satellite Command and Control systems including the Global Positioning System and the Hubble Telescope Project. Tom has also been a teacher and mentor primarily in the area of integration and test.

Tom is also a corporate member of the National Defense Industrial Association (NDIA) co-chairing the DT&E Committee. He has been a presenter at the Aerospace Testing Seminar (ATS) and is a member of the ATS Advisory Board. He has also been a speaker at the NDIA SE Division Conference as well as a Keynote Speaker at STAREAST and at STARWESTs Leadership Session.

Tom grew up in Florida developing a desire to work in engineering watching the Space program. He has a Bachelors degree in Computer Science from Florida Atlantic University. Tom has been married for 37 years, has three boys and three grand kids.