Raytheon

Customer Success Is Our Mission

NDIA National Test & Evaluation Conference

The Value of the Test Architect

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The Conference Focus

"The proper <u>role</u> of Test & Evaluation
in our Defense System <u>Requirements Process</u>"

What is a Test Architect?

- Chief Engineer for Test
- Systems Thinker
- Systems Engineer
- Test Program Director
- Domain Expert
- Collaborator
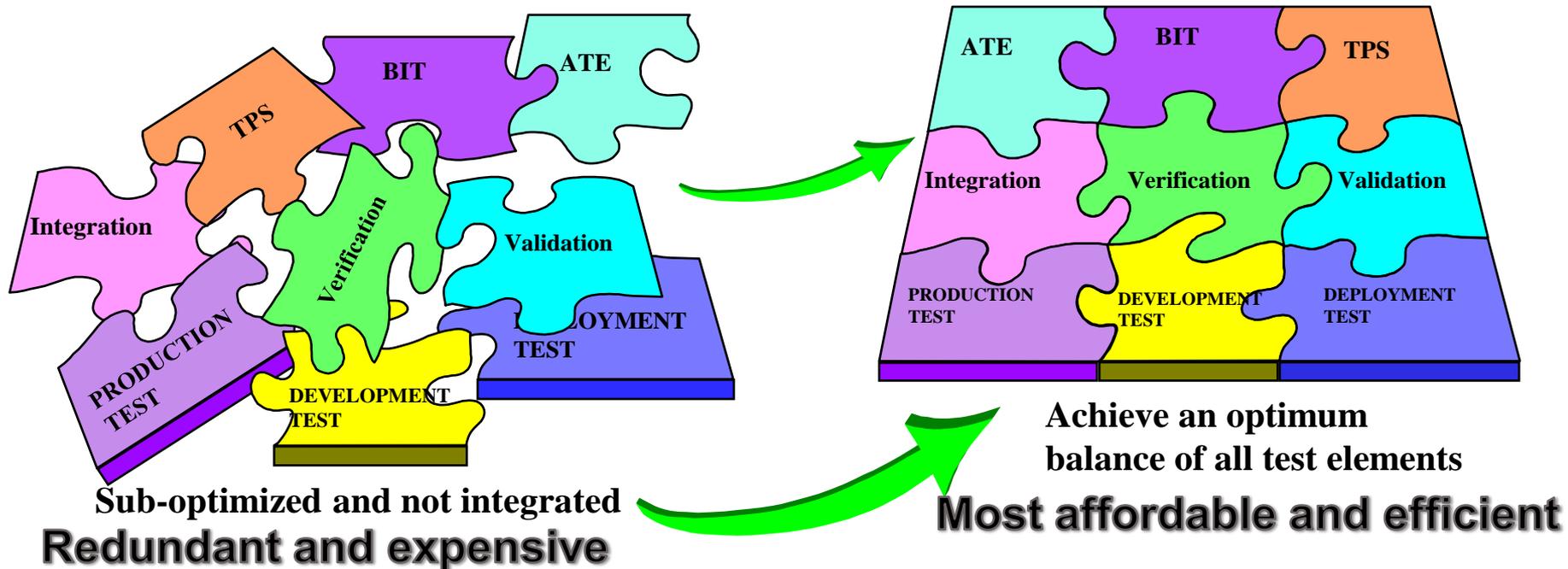- Communicator
- Mobilizer

What does a Test Architect do?

- Establishes consolidated life cycle test strategy
- Takes ownership of test strategy implementation
- Leads development of test architecture
- Maintains visibility and governance into test development
- Facilitates cross domain knowledge
- Ensures consistency throughout life of program
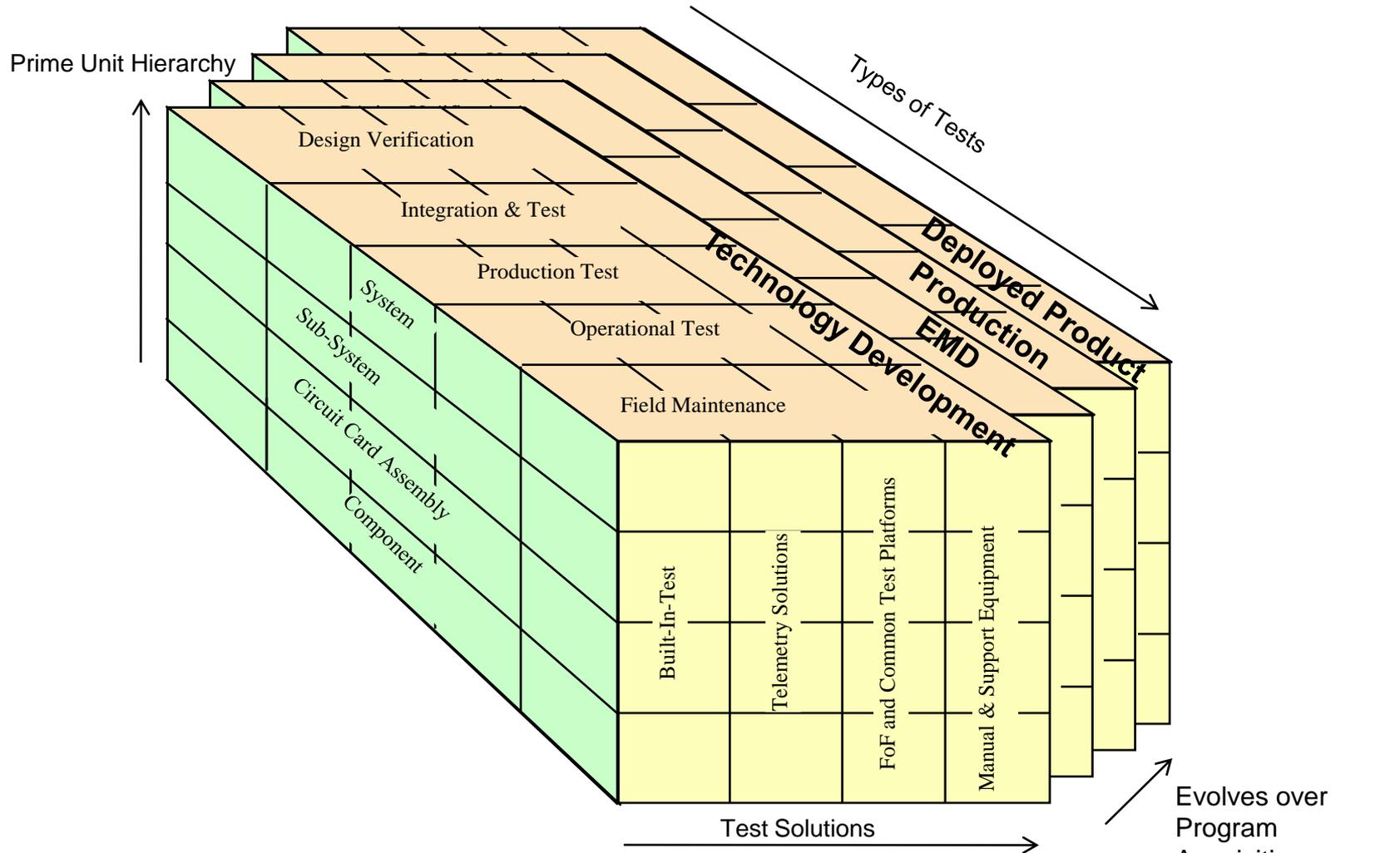
What is Test Strategy & Architecture?

Test Strategy & Architecture is the process of **planning for** and **executing** the integration, coordination, and optimization of **all** program **test-related activities**.

It is **Systems Engineering** as applied to test in order to achieve the most **affordable solution** that gives us the necessary **mission assurance**.

Sub-optimized and not integrated
Redundant and expensive

Achieve an optimum balance of all test elements
Most affordable and efficient

TPS = Test Position Station (TE), BIT= Built-in-Test, ATE=Automated Test Equipment

Optimized Test Strategy & Architecture

Prime Unit Hierarchy

Types of Tests

Design Verification

Integration & Test

Production Test

Operational Test

Field Maintenance

System

Sub-System

Circuit Card Assembly

Component

Technology Development

EMD

Production

Deployed Product

Built-In-Test

Telemetry Solutions

FoF and Common Test Platforms

Manual & Support Equipment

Test Solutions

Evolves over Program Acquisition Phase as Product Matures

Test Strategy & Architecture Optimizes Life Cycle Cost Over Levels of Assembly and Across Test Types

Test Architect Scope

Interaction with Design

- Influence Design for Test
- Identify test related design requirements
- Coordinate BIT development and use
- Ensure test requirements are consistent with test strategy
- Evaluate effects of requirements changes on test strategy
- Ensure data is collected for requirements and model validation

Planning for Production

- Optimize Production Test Strategy for AUPP and Mission Assurance
- Coordinate test reduction planning

ATE	BIT	TPS
Integration	Verification	Validation
PRODUCTION TEST	DEVELOPMENT TEST	DEPLOYMENT TEST
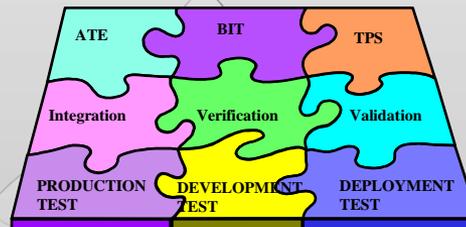
Test Related Supplier Oversight

- Develop and oversee technical aspects of supplier test strategies
- Coordinate test requirements and test plans with suppliers

Understanding Customer Perspective (T&E, Warfighter and Support)

- RMS Lead for Program T&E Working Group
- Streamline integration, verification, and validation across contracts and events.
- Ensure "Test as you Fly" philosophy
- Ensure design and test strategy are consistent with depot and upgrade conops

Business Context

- Take into account cost & schedule constraints
- Take into account Enterprise Strategies
- Take into account Customer Strategies

Approach solutions solicited for…

Reviewing requirements from a T&E perspective

Reviewing requirements as they are developed

Early identification of operational concerns to leadership

Early identification of test-critical resource shortfalls to leadership

Approach solutions solicited for…

Testing in the context of realistic operational environments

Testing in a joint environment

Common understanding of planned CONOPS for T&E

Identification of Reliability, Availability, Maintainability requirements

Test Architect Competency Model

Now, let's look at each of those need areas

Reviewing requirements from a T&E perspective

- Has experience on programs in multiple phases of the life cycle
- Understands operationally relevant forms of test and evaluation
- Understands common test methods, equipment and interfaces
- Understands the issues associated with testing all parts of the system
- Performs requirements analysis and flow down
- Architects and coordinates Built-In Test implementations

Write requirements   Verify requirements

← Data

Implement requirements
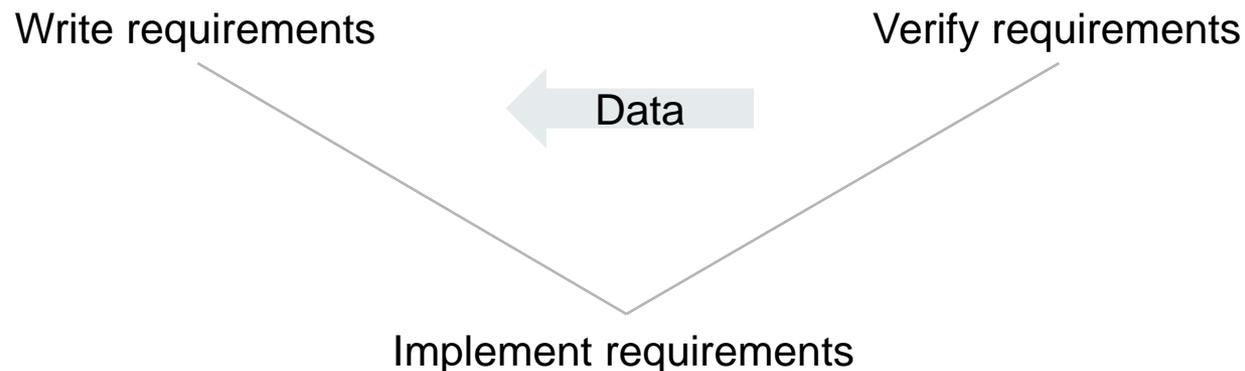
Test Architects have experience and a systems view

Reviewing requirements as they are developed

- Collaborates across a multi-disciplined set of stakeholders
- Facilitates consensus for mutually agreed test solutions
- Understands the various disciplines within the scope of test
- Synthesizes integration and test flows
- Understands the issues and various paradigms associated with supplier test strategies
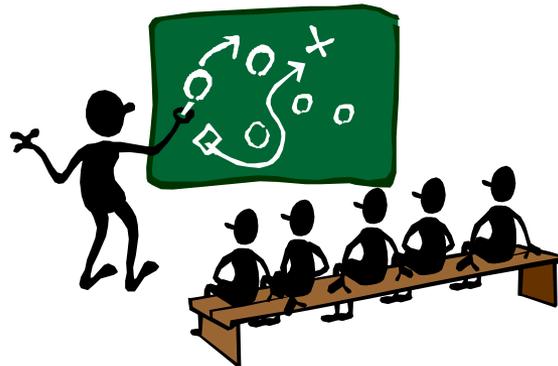
Test Architects pull teams together and facilitate alignment

Early identification of operational concerns to leadership

- Garners influence with program leadership through an attitude of respect
- Understands the issues associated with testing all parts of the system
- Understands and applies the analysis of test data
- Assesses supplier test capabilities
- Assesses team strengths and proactively solicits support from others

Test Architects are members of program leadership "close to the action"

Early identification of test-critical resource shortfalls to leadership

- Understands the various disciplines within the scope of test
- Understands common test methods, equipment and interfaces
- Understands the issues associated with testing all parts of the system
- Synthesizes integration and test flows
- Assesses supplier test capabilities
- Assesses team strengths and proactively solicits support from others

Test Architects analyze test planning and recognize gaps

# Testing in the context of realistic operational environments

- Has experience on programs in multiple phases of the life cycle
- Understands operationally relevant forms of test and evaluation
- Understands common test methods, equipment and interfaces
- Understands the issues associated with testing all parts of the system
- Performs requirements analysis and flow down

Test Architects know the factory and the field

Testing in a joint environment

- Collaborates across a multi-disciplined set of stakeholders
- Conceives, communicates and applies test principles to align stakeholders around a test strategy
- Facilitates consensus for mutually agreed test solutions
- Understands the various disciplines within the scope of test
- Understands and applies the analysis of test data
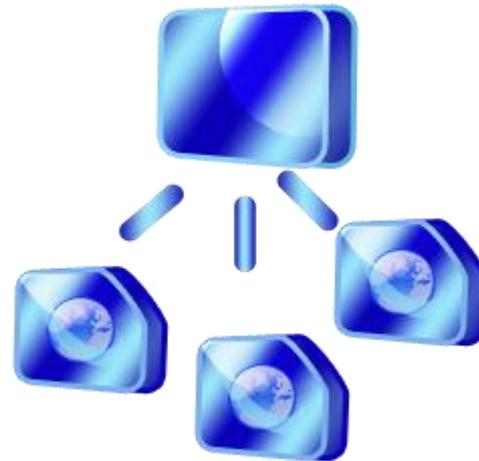
Test Architects collaborate and facilitate diverse teams

Common understanding of planned CONOPS for T&E

- Facilitates consensus for mutually agreed test solutions
- Understands operationally relevant forms of test and evaluation
- Understands common test methods, equipment and interfaces
- Understands the issues associated with testing all parts of the system
- Understands and applies the analysis of test data
- Synthesizes integration and test flows
- Architects and coordinates Built-In Test implementations

Test Architects ensure consistency of practice in test

Identification of Reliability, Availability and Maintainability requirements

- Creates optimized test partitioning from lowest to highest levels of assembly and across program life cycle

- Identifies and performs trade studies

- Architects and coordinates Built-In Test implementations

- Influences design for test with knowledge of design for cost, testability analysis and product design

- Crafts supplier test statements of work

Test Architects bring about visibility into the product and facilitate the complete solution

Recommendations

- If you don't have a Test Architect – Get ONE!
- Write the role into new contracts
- Build the competency among your people

Author Information

James Brewer

Mr. Brewer is a Systems Test Engineering Section Head at Raytheon Missile Systems (RMS) specializing in Test Strategy & Architecture. Mr. Brewer has been with Raytheon since 2007, having spent his 20+ professional years in design, test and project management. His experience spans the product life cycle and the industries of digital electronics, avionics, semiconductors, factory automation and embedded software. He has a Bachelor of Science in Electrical Engineering, a Master of Arts in Eastern Classics and other post-graduate work in linguistics, philosophy, software and the sciences. Mr. Brewer oversees the test development on several programs across RMS through his engineering staff and leads the Systems Engineering white space for the RMS Test Systems Solutions Center – Office of the Chief Engineer.

Louisa Guise

Mrs. Louisa Guise is currently the Strategy Deployment Lead for the Raytheon Missile System (RMS) Systems Test Directorate. In her role, Mrs. Guise is responsible for identifying and implementing strategic initiatives for test. For the last three years, Mrs. Guise has been defining the discipline of Test Strategy & Architecture and the role of the Test Architect. She has been with Raytheon for 29 years, holding positions of leadership, primarily in Modeling & Simulation. Mrs. Guise holds a BS in Biomedical Engineering and an MS in Systems Engineering, both from Boston University.

Jerry Emmert

Mr. Emmert has a Bachelor of Science degree in Computer Systems Engineering Technology and a Master of Science degree in Computer Information Systems. He has 26 years of experience in test system design and development. During his time with Raytheon, Mr. Emmert has contributed extensively in the design and implementation of many test and simulation systems. Mr. Emmert shares a patent for the "Programmable Advanced Systems Interface Simulator (PASIS®)" and has published work in the area of VXI performance as well as Utilization of Testability Modeling. Mr. Emmert is presently working as a Test Architect for Raytheon Missile Systems in Tucson, Arizona.