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Customer Success Is Our Mission

Systems Engineering for Test: Providing the Right Testing at the Right Time

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Agenda

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- Define Test Strategy & Architecture at Raytheon Missile Systems
- Define the Role of System Test Architect

The Need…

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- Raytheon's response to the need for "Better Buying Power" through finding T&E efficiencies
  - Reduce the amount of testing
  - Increase test efficiency
  - Use of T&E to reduce the overall cost of acquisition
- Mission Based T&E for more operationally relevant testing
- Early T&E involvement

The right testing at the right

Raytheon Missile Systems: Response to The Need…

Raytheon Missile Systems

- Created “Test Strategy & Architecture” discipline

- Developed deliberate approach to
  - Evaluate system and test requirements early
  - Influence the design for testability
  - Optimize test coverage, costs and mission assurance over the product life cycle

Testing for the Right Purpose

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Engineering testing is executed to

- verify system design meets requirements **AND**
- characterize design margin and reliability to identify what needs to be tested in production and deployment (e.g., Key Product Characteristics) **AND**
- ensure suitability to end users' need

Production testing is executed to

- verify product assembly **AND**
- ensure Key Product Characteristics are meeting specifications **AND**
- to collect statistical process control data

Testing during **deployment** is executed to

- verify operational availability **AND**
- verify field installation of upgrades

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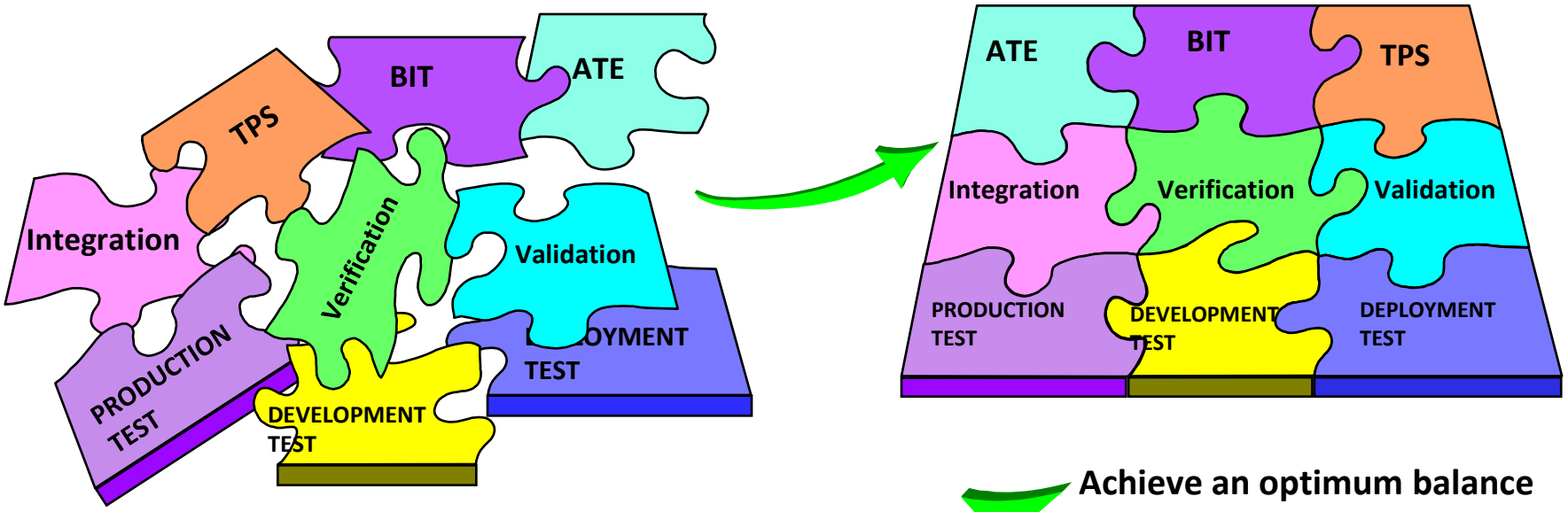
What is Test Strategy & Architecture?

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**.



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

Test Strategy & Architecture: A Multi-dimension Approach

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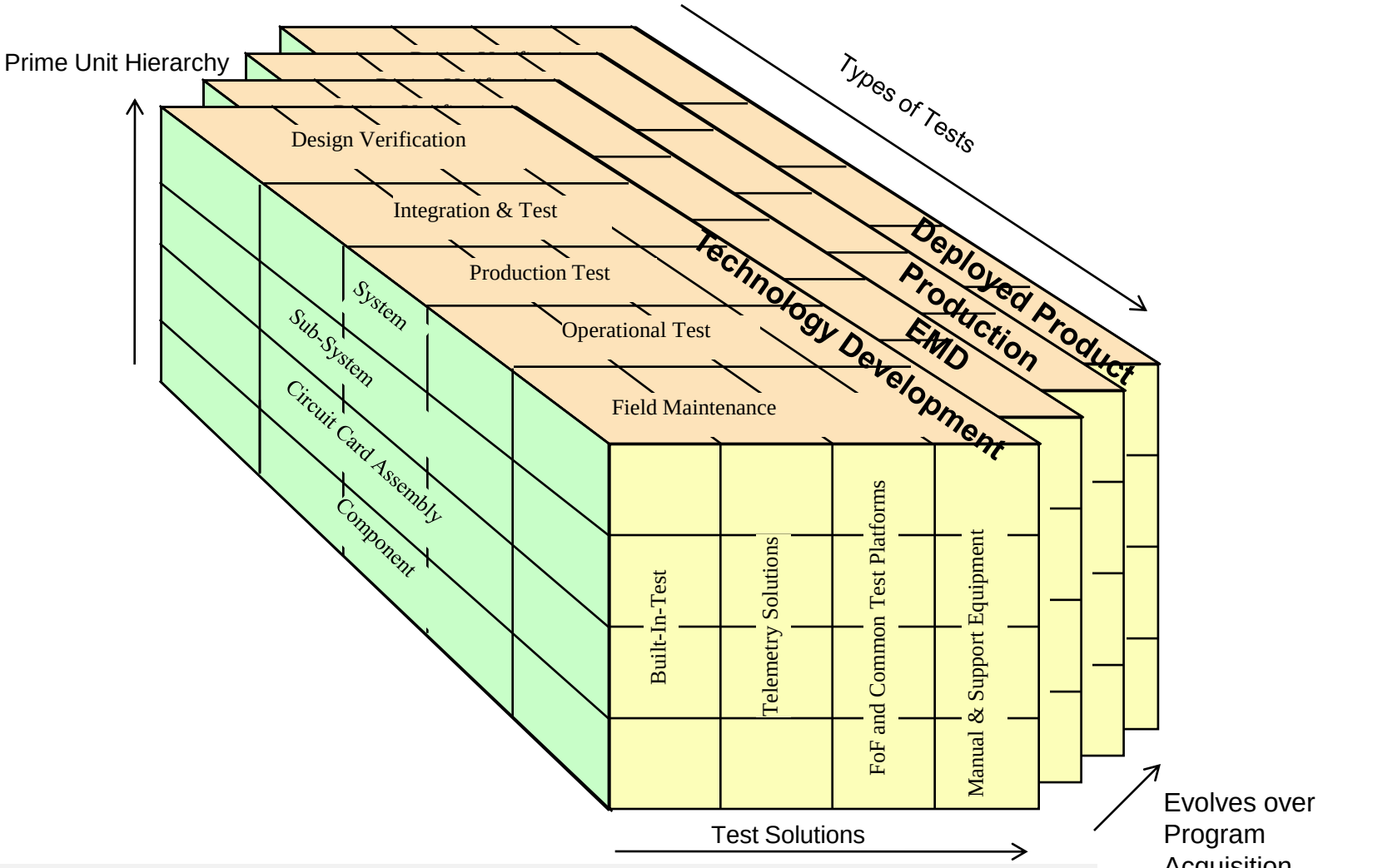
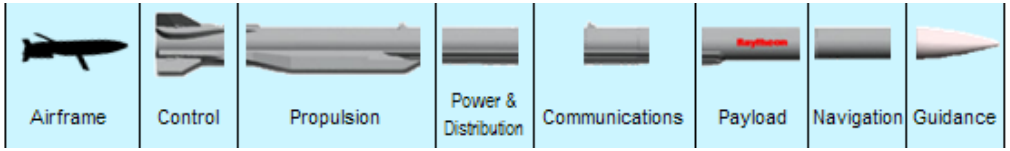


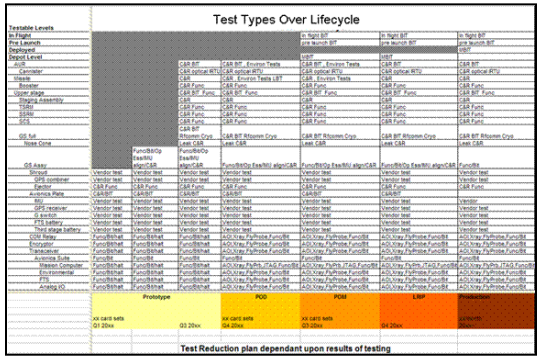
Test Strategy & Architecture Optimizes Life Cycle Cost Over Levels of Assembly and Across Test Types

Test Architecture Perspectives



Product Perspective
Architecture / Interfaces
Testability (accessibility, coverage, fault isolation)
BIT / Embedded Test
Data Collection / Telemetry
etc.

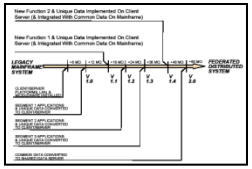
Tests Over Lifecycle



Customer Perspective

T&E Strategy
OV-1

Technology Forecast



Types of Tests

- Design Characterization
- Integration Testing
- Maturation Testing
- Verification Testing
- Reliability Testing
- Qualification Testing
- LRIP Testing
- FRP Testing
- Depot Testing
- Pre-launch Testing
- DT&E
- OT&E

Test Platform / Environments

Informal / Lash-up TE
Formal Engineering TE
Production TE
Environmental Test Facilities
CIL/HIL
SWES
Flight Test Ranges

Technology Testing

RF
EO
GPS
Nav
Etc.

Cost of Test

Lifecycle Test Cost Models

Test Principles

Develop Program Lifecycle Test Strategies
Design for Test
Test, Learn and Correct Early
Test to Validate Models
Test as you Fly Relative to the Intended Operational Environment
Minimize Re-Test in Production
Test to Demonstrate Margin

Test Documentation

PCTP
TRD
AUM
VIS

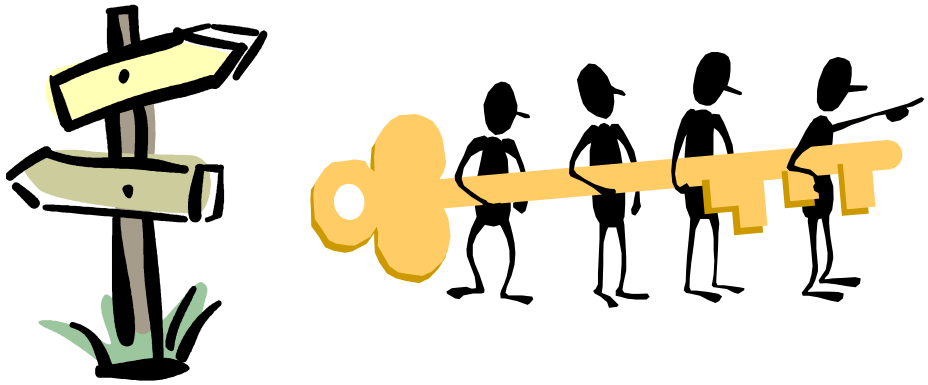
Test Tools

ITLOG
DSIeXpress
DOE …

Knowledge Repository

Dictionary | Templates | Best Practices | Processes / Cmd Media | Program Knowledge Transition Data

The test architect takes the lead integrating the collective efforts of the various Engineering and Manufacturing IPTs in driving Test Strategy & Architecture forward.



The Role of the Test Architect

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- Test Architect
  - Drives the integration of test activities across the entire program life cycle consistent with the customer's Test and Evaluation Strategy and Master Plan.
  - Develops the lifecycle test strategy and guides the development of the lower level test strategies.
  - Ensures appropriate resources to execute the test strategy.
  - Influences other aspects of the system design to ensure that the test strategy is being executed.
  - Works with system architects, engineers and designers to ensure testability is being driven into design.

The Test Architect may be thought of as the chief engineer for test

Test Architect Scope

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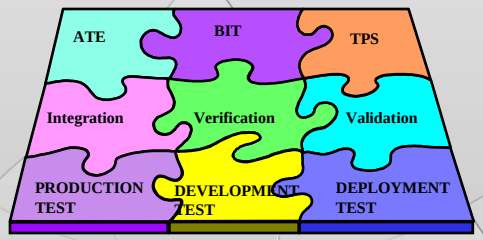
Interaction with Design

- 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



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

Raytheon Missile Systems
Chief Systems Test Architect

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- Engages with programs to establish an approach for the development and execution of test strategies & architectures that optimize affordability and mission assurance.
- Provides leadership and direction to program test architects to ensure appropriate development and execution of test strategies & architectures
- Serves in the role of test architect on key strategic programs
- Drives the integration of test strategies & architectures across RMS
- Owns test strategy & architecture development process
- Drives the talent development for test architects
- Leads the test strategy & architecture learning team for Systems Test
- Leads the RMS engagement with other Raytheon Business Units, customer organizations and professional societies around test strategy & architecture
- Drives test strategy & architecture related special projects

Joe Manas is the RMS Chief Systems Test Architect

Summary

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- At Raytheon Missile Systems we are taking a Systems Engineering perspective on test
  - Developed processes, tools and enablers to support the deliberate development of test strategies and architectures
  - Developing some common, re-usable test strategies and architectures
  - Implemented the role of test architect on programs and Chief Systems Test Architect

Questions?

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