The Driving Need

- The cost of **Test** on a program is conservatively estimated at 30% of the total cost of a development program

- What is Test? (it encompasses a lot)
  - Prototype Integration & Testing in the lab
  - HW Design Verification Testing
  - Environmental Qualification Testing (MIL-STD-XXX)
  - Testing for simulation validation
  - Field & Flight Testing
  - Cybersecurity Testing
  - Interoperability Testing
  - Software Testing
  - Integrated Testing
  - Factory Acceptance Testing
  - Operational Availability Testing
  - More…

There are so many elements of “test”. Quite often the test teams may be separated geographically and also by products & discipline – especially on large programs.

**Are You Spending That 30% Wisely?**
Our Solution

- Life Cycle Test & Evaluation Strategy & Architecture
- Led by the Test Architect
  - Role established in 2011
  - Drives the integration of all test activities across the entire program life cycle consistent with the customer’s test and evaluation strategy.
  - Develops the lifecycle test strategy and guides the development of the lower level test strategies.
  - Works w/ System Architects, Chief Engineers and Technical Directors
    - Testability is being driven into design
    - Incremental capabilities are being considered for efficient IV&V
- Key member of the Change Control Board – The persistent conscience of test
- May be thought of as the “Chief Engineer of Test”
Test Architect Competency Model Defined

- **Executive Leadership**
  - The ability to lead by influence

- **Technical Abilities**
  - Test & Evaluation – Across the Lifecycle
  - Architecture for Test
    - Influencing the System Architecture for IV&V
    - Influencing the System Architecture for Testability

- **Program Execution**

- **Understanding of DASD (DT&E)**
  - Deputy Assistant Secretary of Defense for Developmental Test & Evaluation

- **Developmental Evaluation Framework**

- **Business Acumen**

The Ability to Define a Test Strategy & Influence the System Architecture To Realize It
Minimize testing on the ship
Minimize duplication
Minimize product verification on the ship
Early verification
Maximize reuse of procedures
Leverage other verification activities

Test Architect Driving Implementation

Test Lead with Big Picture View
Responsible for Test Strategy and Integrated Testing Implementation

Test Principles

Integration Principles
- Mitigate the early
- Minimize impact of constraints
- Minimize overall cost
- Minimize overall risk
- Minimize overall testing time
- Minimize overall testing cost
- Minimize overall testing impact

Test Case Design
Integration Information Sheet
Verification Information Sheet

Activity planning that establishes handoffs between teams, activity constraints, and task content

Strategy
Activity flow that reflects application of principles

Plan
Schedule and content that reflects activity flow

Statistical Methods
Detailed description of planned actions and expected outcomes

Procedure
Conduct
Design and optimize test coverage

System Test
Operationally Relevant

Factory Solution

NDIA T&E Div Conf 3/2/16
DoD Chief Developmental Tester

- SecDef shall require each major defense acquisition program be supported by a Chief Developmental Tester
  - “Oversight of all developmental test and evaluation activities for the program maintaining insight into contractor activities under the program and overseeing the test and evaluation activities of other participating government activities under the program; and helping program managers make technically informed, objective judgments about contractor developmental test and evaluation results.”

- A DoD Key Leadership Position (KLP)

NDAA 2012

CDT Role was a Key Driver in Refining the Raytheon Test Architect Role

NDIA 2014 Project helped gain understanding and alignment between Industry & Government Regarding a “Industry Test Lead”
Why Certify?

- Improve the professionalism of the T&E discipline
- Establish higher standards for this critical leadership position
- Establish increased professional qualification requirements for the T&E discipline and consistency across Raytheon
- Develop and promote common standards, principles, procedures, processes, and terms for the T&E profession
- Alignment with DASD (DT&E) initiatives for CDT KLP Qualification and Better Buying Power 3.0 professionalism initiative
- Provide a defined career path for our T&E workforce
Raytheon Test Architect Certification

- **Education & Training Requirements**
- **Demonstrated:**
  - Executive Leadership
  - Technical Abilities
  - Test & Evaluation – Across the Lifecycle
  - Architecture for Test
  - Program Execution
  - Understanding of DASD (DT&E) Developmental Evaluation Framework
  - Business Acumen
- **Endorsement**

**Required Training combined with Demonstrated Performance on Programs**
Summarize

- Life Cycle Test & Evaluation Strategy & Architecture
  - A Systems Engineering Approach to Test

- Led by the Test Architect aka Industry Test Lead
  - Define a Test Strategy & Influence the System Architecture To Realize It

- CDT Role was a Key Driver in Refining the Raytheon Test Architect Role
  - NDIA 2014 CDT Project helped gain understanding and alignment between Industry & Government
Abstract

The Raytheon Test Architect may be thought of the “Chief Engineer for Test” on a program. He/she drives the integration of test activities across the entire program life cycle, ensuring consistency with the customer's Test and Evaluation strategy and defining the test architecture for the production solution. This paper will discuss the evolution of this role at Raytheon, the established competency model and the recently defined certification process.
Biographies

- **Joe Manas** is a Senior Engineering Fellow with Raytheon Company. Over the last 30 years, he has worked within the defense & aerospace industry, 25 years of which has been with Raytheon. Joe has held leadership positions in the disciplines of System Engineering, Software Development and Test & Evaluation across multiple product lines. He holds a B.S. in Electrical Engineering from Worcester Polytechnic Institute, MA.

- **Martin Leek** is a Senior Principal Systems Engineer who earned his MS from Webster's University of Saint Louis. After a 22 year career in the US Army which included a combat command of a PATRIOT Battalion during Desert Sentry and assignment as Integration Lead for the Cheyenne Mountain NORAD Upgrade, Martin joined Raytheon in 1996 where he has worked as a requirements developer, IPT Lead, operational analyst, functional manager, and directorate learning champion on command and control and radar programs. He is currently the IDS Engineering Integrated Learning Development Program Learning Champion for the Systems Validation Test and Analysis Directorate. Previous assignments have included operational staff functions analyst for the THAAD Command and Control system, Weapon Systems Integration IPT lead, and Raytheon Certified Six Sigma Expert.