Tomahawk Simulation Management

A Presentation for the NAVMSMO VV&A Technical Working Group Workshop

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28 September 2000

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Purposes

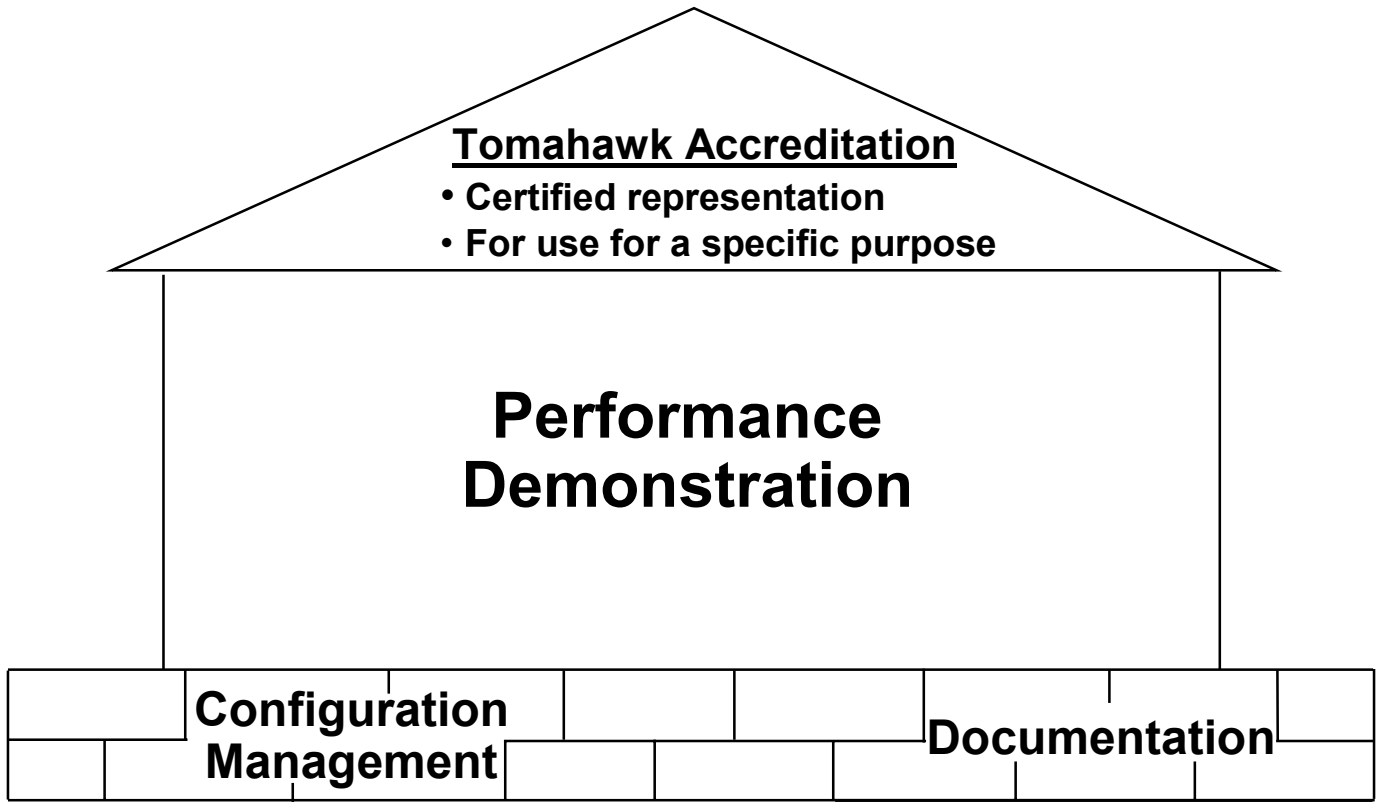
- To Provide an Overview of Tomahawk Simulation Management
- To Discuss Our Relationship with Commander, Operational Test and Evaluation Force

History

- **Problem Statement from *JCMPO 00/211 dated 14 March 83***
  - **"Different Tomahawk… simulations have been developed and are being used by various… activities."**
  - **"The assured interpretation of results obtained from one or another model is at best difficult. An in-depth understanding of the applicability and limitations of individual simulation outputs in relation to results derived from other models is often a difficult undertaking."**

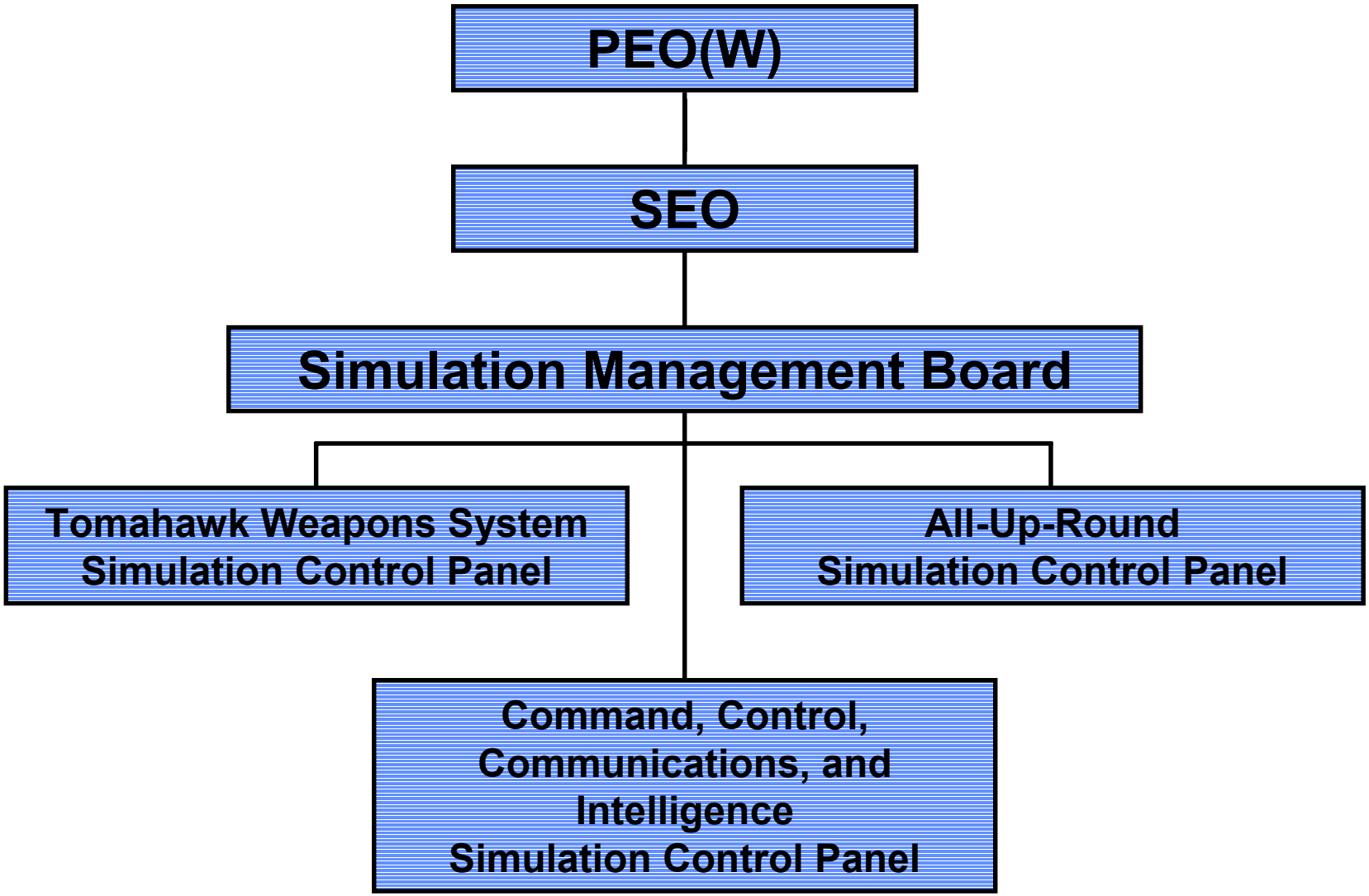
- **Problem Solution: Tomahawk Simulation Management**
  - **Originated under JHU/APL leadership in 1983**
  - **Established organization, plans and procedures, and responsibilities to provide information for assured interpretation of simulation results**

Building Tomahawk Simulation Accreditation



- **Tomahawk Simulation Management defining documents (i.e., the blueprints for the building)**
  1. Tomahawk Simulation Management Policy, PEO(CU)INST 5232.1, 19 July 93.
  2. Tomahawk Simulation Management Plan, PEO(CU) 5232/4, December 1998.
- **Tomahawk Simulation Management was established in 1983 under charter from RADM Hostettler.**

Tomahawk Simulation Management Organization



Accreditation Process

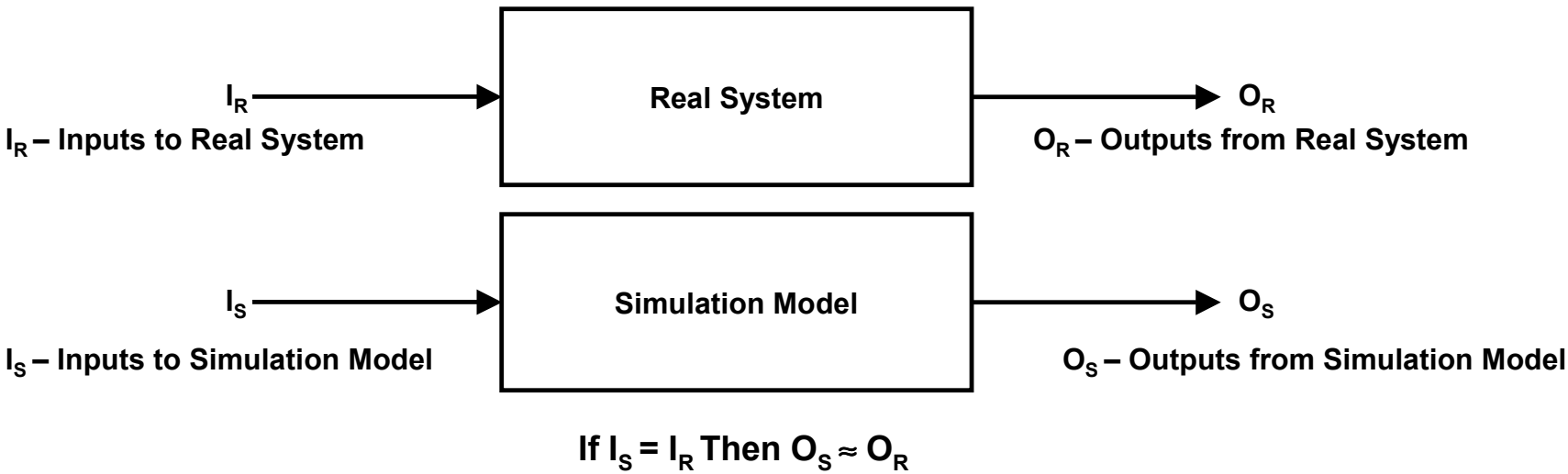
- **Process is applicable for accreditation of new or updated simulations as well as expanded application of an accredited simulation**
  - **Authorize simulation**
  - **Approve Accreditation Plan**
  - **Present Accreditation Report to SCP**
    - **Documents validation results of Accreditation Plan**
    - **Includes technical demonstration of correctness and consistency by one or more methods**
      - Validation by comparison with test data
      - Validation by comparison with other accredited simulation results
      - Validation through audit of technical data
    - **SCP reviews and approves report and documentation**
  - **Certificate is awarded by SMB after recommendation by cognizant SCP**
    - **SCP recommendation approved or action items assigned for completion prior to approval**
    - **ALL accreditation material in Tomahawk Simulation Archive for full accreditation**

Accreditation Plan

- Organization responsible for simulation prepares plan for SCP approval
- Plan contents
  - Definition of simulation representation and areas of applicability
  - Definition of checkcases
  - Sources of test data to be used for validation
  - Data items and parameters to be validated
  - Metrics used to determine validation success and presentation format
- Tomahawk Simulation Catalog is companion document
  - Describes conceptual models, functionality, and verification
- SCP approves plan if:
  - Plan demonstrates features and capabilities to sufficient depth and scope
  - Available validation data has adequate calibration and credibility
  - Encompasses the complete domain of requested accreditation

How TSMB Validates AUR Simulations

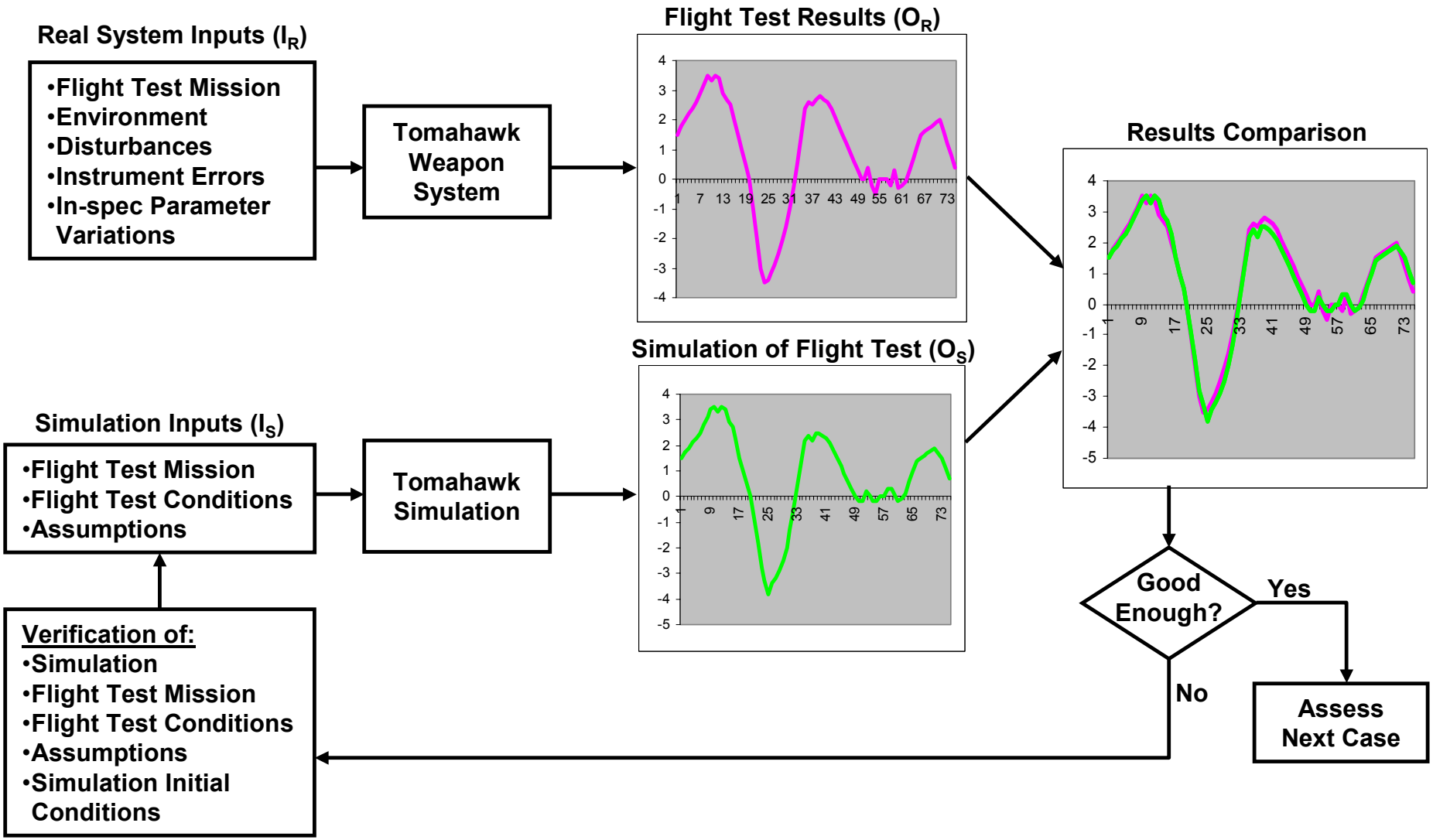
- **Results-based validation using subject matter experts**
  - ✓ Tough-minded Simulation Control Panel
  - ✓ SCP assesses validation data credibility and simulation results prior to use
  - ✓ Accreditation effort builds consensus and is ongoing
  - ✓ Validation is difficult because important real world inputs can be unknown or poorly calibrated
- **The Validation Process**



If $I_S = I_R$ Then $O_S \approx O_R$

The SMB has never fully accredited an AUR simulation without results-based validation traceable to missile flight test.

An Example Showing Results-Based Validation



Tomahawk Simulation Accreditation

Full Accreditation: All requirements have been met.

Provisional Accreditation: Performance has been essentially demonstrated but all requirements have not been met.

Limited Accreditation: Validation is incomplete although all data indicates correct performance.

- Typically applies for an emerging development or when no real-world data exists.
- The accreditation limitation is expressed on the certificate (e.g., Full Accreditation <u>for development flight test prediction</u>).

Site Accreditation: Applies when an accredited Tomahawk simulation is installed and used at an alternate site.

- **Accreditation applies to:**
  - ✓ **All <u>TWS models and simulations</u> producing results that are presented outside the responsible organization.**

Generic TSMB Accreditation Certificate

TOMAHAWK Simulation Management Board Certificate

To: Simulation Using Organigation

From: TOMAHAWK Simulation Management Board

Subject: [**Full; Provisional**]{Site}{Reference Simulation/Model/Database} **Accreditation** {limitation} of _____ {at _____}

Accredited to Represent: _____

For Use In: _____

Responsible Organization: Simulation Responsible Organization

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This Limited Accreditation is for:

Version **Dated (version date)**

Based on the following major activities:

[**X** _____]
{**X** _____}

Previous Accreditation:

[Initial Tomahawk Accreditation/Version, Date]

The following materials support accreditation:

__ Accreditation Plan
__ Accreditation Report
__ Configuration Control Plan
__ Current Catalog Entry
__ Version Description Document
__ Users Manual
__ Benchmark Checkcases
__ Reference Checkcases
__ Source Code/ Listing

Accreditation Recommended:

AUR-SCP Co-Chair: _____
Date

AUR-SCP Co-Chair: _____
Date

Accreditation Approved:

_____
Co-Chair, Tomahawk Simulation Management Board Date

TSMB Relationship with COTF

- **Originated with briefing to DOT&E in May 1992**
  - Briefed history and accreditation activities
  - Oriented toward simulation-based operational test
  - Resulted in acceptance of Tomahawk accreditation
- **Expanded/formalized for TBIP and Tomahawk Weapon System**
  - RADM Zerr proponent of Tomahawk Simulation Management
  - COTF membership on Simulation Control Panels
  - Relationship being strengthened for Tactical Tomahawk
- **COTF accreditation based on Tomahawk accreditation joint review**
  - Independent accreditation by COTF
  - SAIC Block III Tomahawk Register Level Simulation V3.01 and NSWC/DD Ship/Sub Environment and Missile Simulation V2.0 have received COTF accreditation
- **Bottom line: COTF has established active role on SCP team. Gains insight and provides input into Tomahawk simulation accreditation right from the start.**
  - Assesses adequacy of Accreditation Plans

Summary

- **Tomahawk Simulation Management is successful**
  - Commitment of Tomahawk program management
  - Provides assured interpretation of results
  - Multiple simulation improvements through accreditation
  - Consolidated management of shared simulations
  - Recognized by COMOPTEVFOR
- **Tomahawk Simulation Management is cost effective**
  - Overall savings in flight test reduction and site accreditation
- **Tomahawk Simulation Management adapting to Tactical Tomahawk program**
  - New weapon, new models and simulations, no flight test data
  - Accreditation to support AUR requirements verification, COI resolution, and OT&E
- **Tomahawk Simulation Management implementing DoN VV&A procedures**
  - Updated Tomahawk Simulation Management Policy in work