Test & Evaluation in the Virtual World

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Motivation

- Changes in weapons systems
  - Increased ranges
  - Complexity of environment

- Horizontal convergence
  - Live – Virtual – Constructive

- Vertical convergence
  - Analysis
  - Testing
  - Training
  - Mission rehearsal
  - Operations
Component Systems

- OneSAF Objective System (OOS)
  - Provides context, environment and synthetic convoy
- Common Architecture Desktop/Embedded Trainer (CADET)
  - Provides a virtual simulator with the embedded high fidelity vehicle simulation using MATLAB/C++ model
- Talon Robot
  - A live robot that is capable of interacting in the synthetic environment
- Expedition Dismounted Infantry (DI) representation
  - Provides a dismounted infantry immersive environment
- Test and Training Enabling Architecture (TENA)
  - Functions as middleware for live testing
- Unmanned Systems Test Bed (USTB)
  - Emulates an unmanned aerial vehicle (UAV)
- Modular Analysis Test Support System (MAnTSS)
  - Collects and analyzes testing data
Notional System Architecture

- MAnTSS
- TENA
- Unmanned System Testbed
- Expedition DI
- OOS
- High fidelity vehicle models
- Talon UGV
- Crew Station

*Time Space Positioning Information (TSPI) Object Model*

*Provides Context*

*Controls*

*Embedded in*

*TENA*

(DIS)
CADET Crew Station

User

Controls

Visualization

Crew Station

External Interface

OOS (modified)

High fidelity vehicle model
## Talon UGV

- **Live system**
  - Controlled by OOS
    - Replaced lower level synthetic elements with actual drivers
  - Teleoperated by joystick
- **Turret**
  - Remote camera
  - Blank firing M-16
- **Wireless Networked**
  - 802.11
Lightweight communication designed to connect live systems
Domain specific optimization over traditional interoperability protocols
Emerging standard for range systems
Time Space Positioning Information (TSPI) Object Model
Notional Scenario

Location
- Kauai Pacific Missile Range Facility (PMRF)

Entities
- UAV (synthetic from USTB)
- Robotic entity (live on blocks)
- Stryker variant (controlled by crew station)
- Trucks / Targets (synthetic from OOS)
- Human (synthetic from Expedition DI)

Actions
- The UAV sees a small (3-4) convoy of trucks
- The Stryker moves to and engages the trucks
- The human and robot inspect the damage to the trucks
Scenario Participants

- **Vigilante UAV**
  - Driven from the USTP
  - In reconnaissance mode

- **Four trucks (targets)**
  - Generated from OOS
  - Convoy driving down road

- **Stryker Vehicle**
  - Driven by the crew station
  - Hybrid electric drive model controls dynamics
  - Attacks convoy

- **UGV**
  - Physical device on blocks
  - Tasked by OOS/Crew Station
  - Inspects convoy after attack by Stryker
Scenario
Interoperability Issues

- TENA
  - TSPI object model
  - Reference version was used

- HLA
  - TBD FOM
  - Version: RTI-1.3, Matrex version 4.2

- Terrain Data
  - Kauai Pacific Missile Range Facility (PMRF) High Res
  - The digital raster graphics is at: http://www.hinhp.org/website/hawaii/kauai/data/drg.zip.
  - Shape files and some others are at: http://www.hinhp.org/website/hawaii/kauai/data.html.
Results

■ Success!
  – By the time the show opened everything worked
  – And then extended on the show floor

■ Terrain registration
  – Common source
  – Control over generation process

■ OOS Modular Communication Interface modification
  – Modified HLA interface with TENA

■ High Fidelity Engine/Suspension Model
  – Wrapped in OOS component model
  – Proxy implementation to remote computer

■ Transparent interaction among elements