Live/Virtual/Constructive Testing and Training

Interactive Systems Simulation and Analysis (ISSA) Department

Fact Sheet

Introduction

As the rate of technology development increases, problems associated with complex, dynamic security issues and systems call for a new approach to system design, evaluation, and training. Choices must be made to optimize design while reducing cost, especially when new technologies must operate with existing hardware and software. Sandia National Laboratories Live/Virtual/Constructive testbed provides the capabilities needed to meet these challenges.

Sandia's LVC simulations provide the ability to perform design trade studies, testing, experimentation, and training involving interactions between Live (real), Virtual (human-in-the-loop gaming, telepresence, or real equipment located at a remote site) and Constructive (computer generated) entities.

Complex systems and scenarios often exhibit unexpected behaviors that cannot be predicted a-priori using the traditional engineering design process. Live/Virtual/Constructive (LVC) testing allows designers to explore complex system requirements in depth, discover problems during the design phase, provide more effective training, and monitor system performance throughout operations. LVC is a systems-of-systems analysis tool because it allows one to work with all components of a system and evaluate how it performs as a whole.

LVC option space allows selection of how many real players or assets are utilized versus how many are simulated. LVC choices can then be made to reduce cost, improve safety, and consider security requirements where training and operations take place. For example, dangerous objects can be present in live environments as an empty inert container while the object's behaviors are simulated in real time and projected back into the live environment.

Capabilities required to build an LVC testing and training environment include significant investments in modeling and simulation, robotics, communications hardware and training systems. Sandia National Laboratories occupies a unique position in that it already has all of these capabilities in house at its Robotic Vehicle Range and Augmented Reality facilities.

The Approach

Sandia has integrated existing assets to build LVC testing & training capabilities. These include:

- Physics based modeling and simulation capabilities developed in Umbra, a modular 3D full physics simulation and analysis framework developed at Sandia.
- Robotic platforms and personnel available at the Robotic Vehicle Range (RVR).
- The Augmented Reality Training System (ARTS), an immersive training system that allows trainees to interact with combined live/constructive environments and constructive threats.
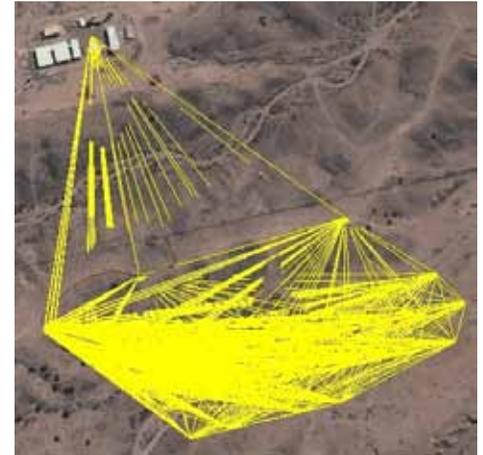

Applications

- System design / tradespace exploration
- CONOPS Development
- New technology evaluation in the relevant operational context
- Mission planning
- Mission rehearsal

The Umbra Model Library

The Umbra model library has been developed over the course of the last 10 years and includes:

- Platform models with fully autonomous control and visual sensors
    - UAV models (both Fixed Wing and Ducted Fan)
    - UGV models with variable levels of fidelity
- High Fidelity models of Ad Hoc wireless
- Communications networks utilizing a co-simulation of Umbra and OpNet.
- Unmanned Ground Sensor models (Multiple sensing modalities validated in field tests)
- Tracking algorithms developed at Sandia National Laboratories
- LAM / PAM models
- Human Avatars at variable levels of fidelity

ARMMS

Swarm

Dixie

RATLER™
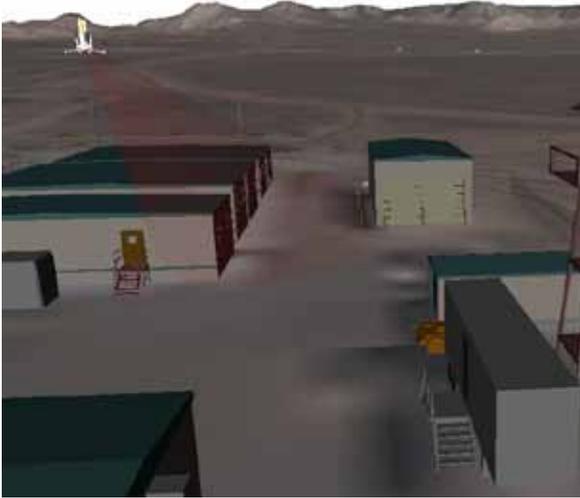
Robotic Assets

(Includes the SandDragon, pictured on the previous page)

Benefits

LVC testing facilitates system design, enabling a spiral development process where interactions and dependencies can be tested before hardware implementation. Sandia is involved in the development of many surety, security, and military projects requiring a high degree of integration between sub-systems, including countermine and counter IED efforts. In cases where a single technology solution does not meet current needs, LVC experiments and training facilitate integration of proposed and existing assets and make testing and integration of these systems much more rigorous and accurate.

Built upon

UMBRA

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NNSA
National Nuclear Security Administration

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