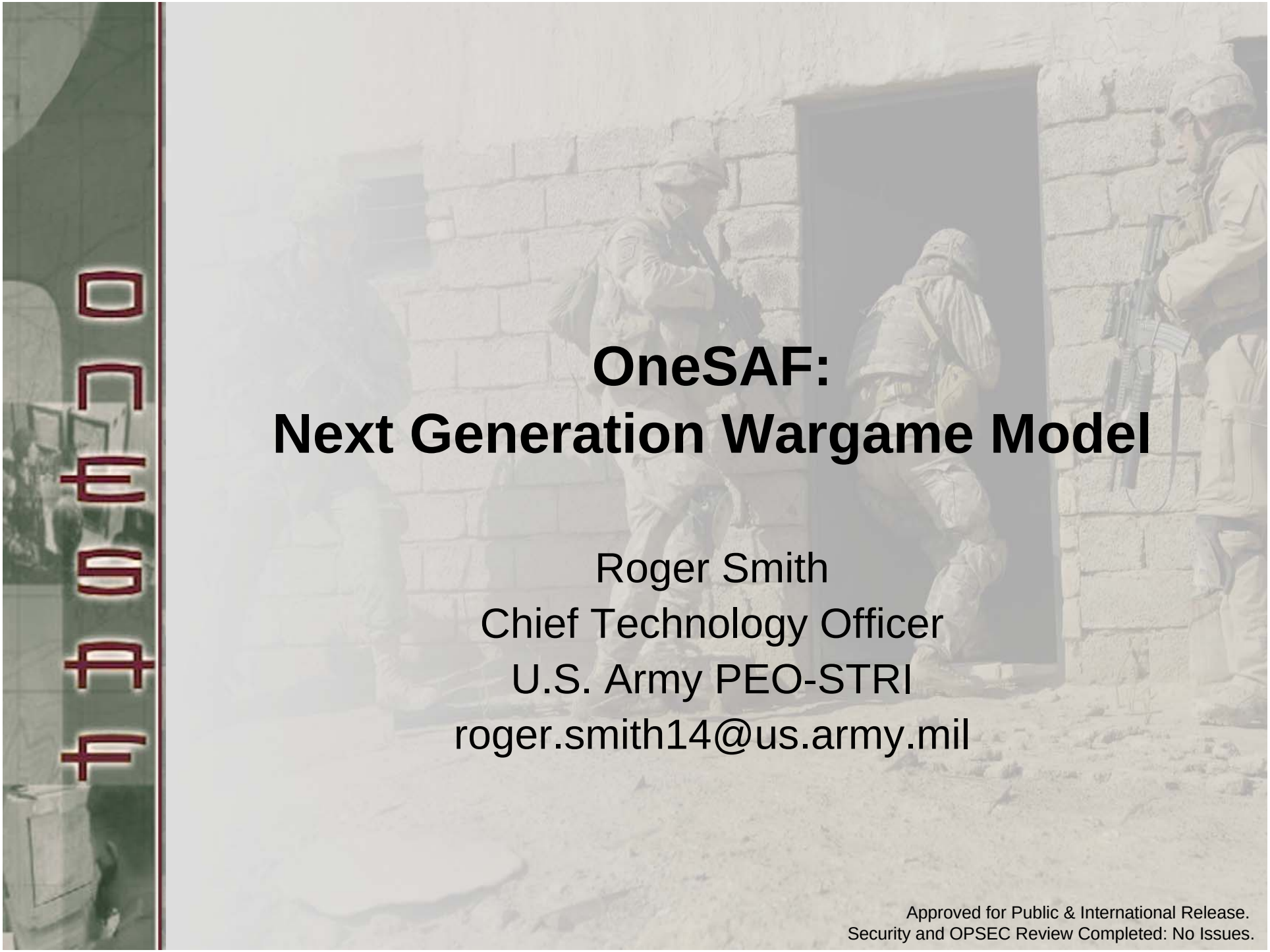
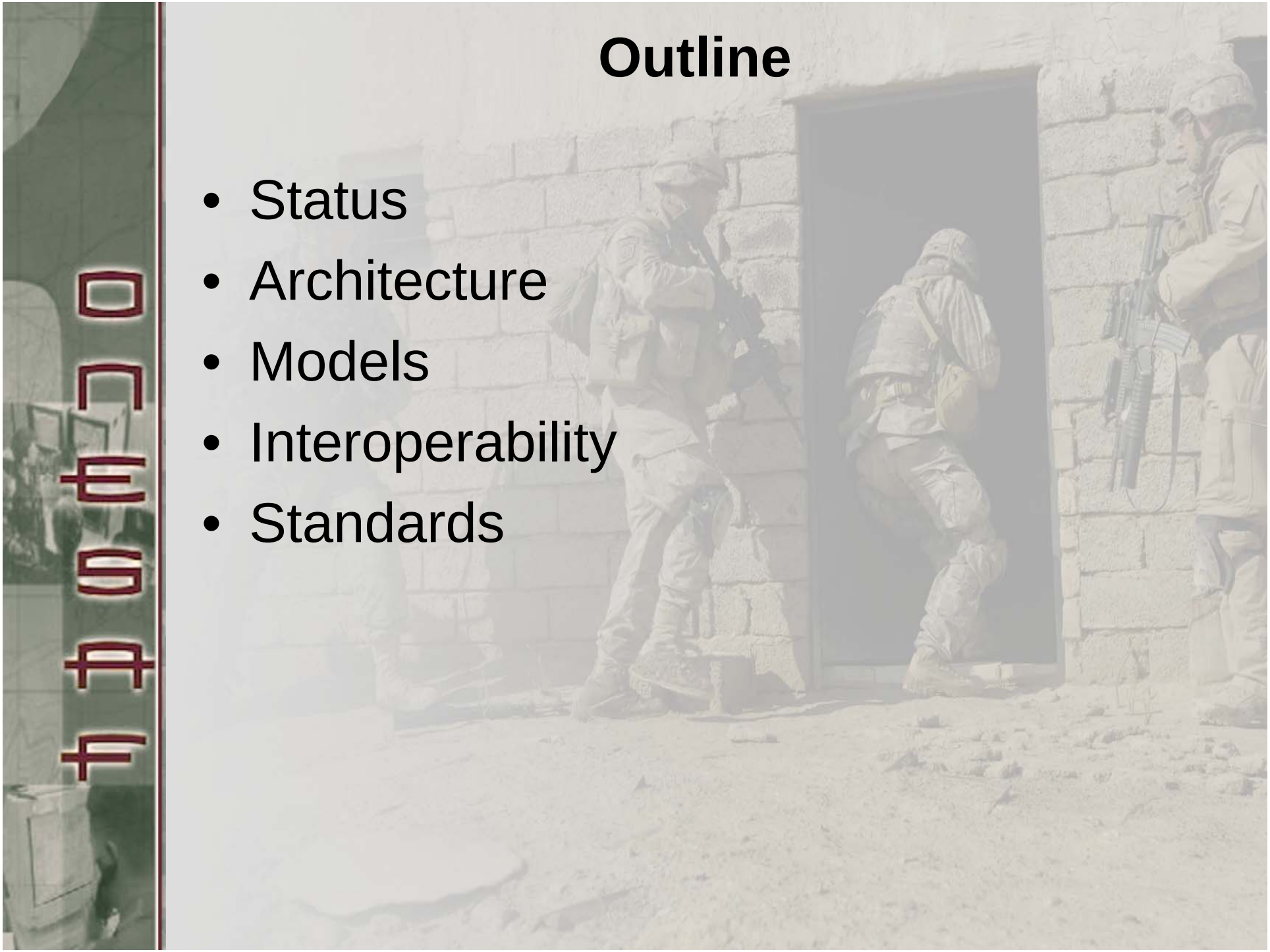


OneSAF:
Next Generation Wargame Model

Roger Smith
Chief Technology Officer
U.S. Army PEO-STRI
roger.smith14@us.army.mil

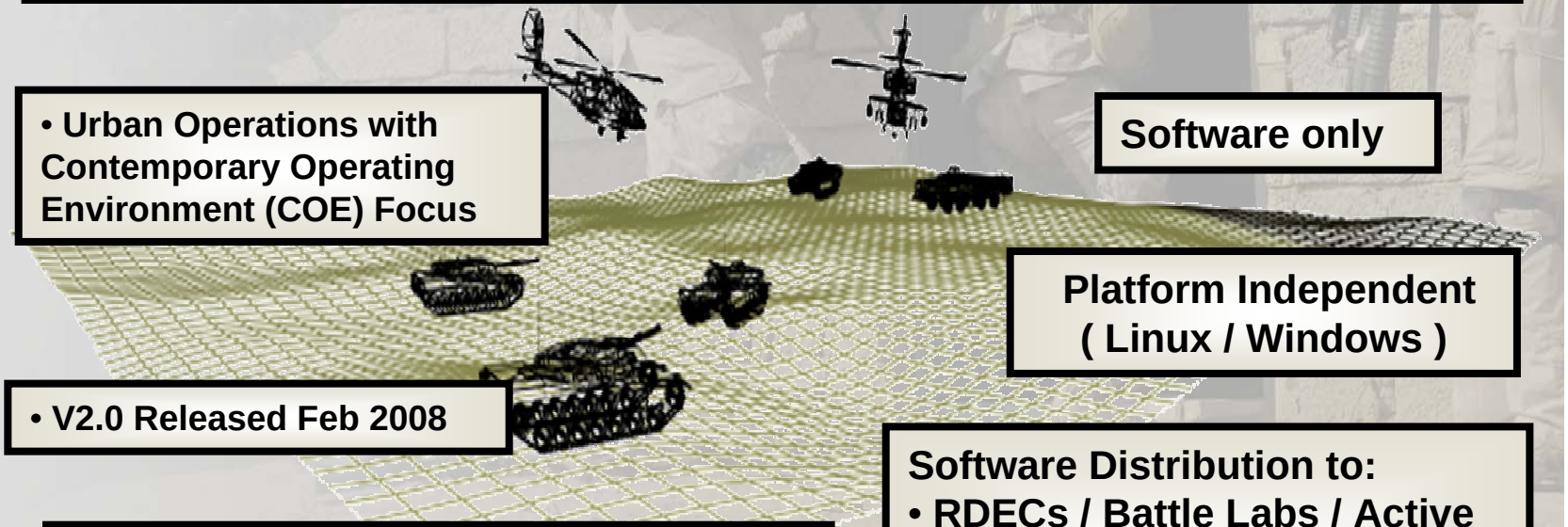
Outline

- Status
- Architecture
- Models
- Interoperability
- Standards



One Semi-Automated Forces (OneSAF)

- A composable, next generation simulation architecture supporting both Computer Generated Forces (CGF) and SAF operations
- Provides a full range of operations, systems, and control processes (TTP)
- Supports modeling from entity up to brigade level
- Supports DIS, HLA, MSDL, JC3IEDM and USA ABCS interoperability
- Provides variable levels of composability, fidelity and representation
- Supports multiple Army M&S domain (ACR, RDA, TEMO) applications.



- Urban Operations with Contemporary Operating Environment (COE) Focus

Software only

Platform Independent
(Linux / Windows)

- V2.0 Released Feb 2008

Capable of replacing US Army legacy entity-based simulations: BBS, OTB / ModSAF, CCTT / AVCATT SAF, Janus (A&T), JCATS MOUT

Software Distribution to:
- RDECs / Battle Labs / Active Duty Brigades & Battalions
- Service / Joint Organizations
- International Partners
- USG / Academia

OneSAF Making a Difference!

PM FCS Tactical Leader Course (TLC) and Soldier Battle Lab in support of ARCIC , Ft. Bliss, Texas

SE Core program integrated OneSAF Environmental Runtime Component (ERC) into CCTT & AVCATT baselines

PM TRASYS (USMC) fields OneSAF in Combined Arms C2 Training Upgrade System (CACCTUS)

PM Radars uses OneSAF for Operator, School House, Combat Training Center, and Staff Training

Robotic Systems Joint Project Office (RSJPO) uses OneSAF for operator training

TRADOC Experimentation uses OneSAF for the Complex Web Defense (CWD) Experiment

USA Space & Missile Defense Command models new space based systems with OneSAF

OneSAF Community

Engaging with Users and External Developers

- Distributed with source code
- Web-based collaboration
  - Commercial best practices
  - Game community novel practices
- User Conferences
- User and Developer training

Joint & Multi-Service Customers

USMC CACCTUS Training System, USAF SIMAF (EAAGLES), AFAMS, JFCOM

•International Project Agreements

Cooperatively developing the OOS baseline

Foreign Military Sales

Associated with the purchase of hardware, software, training, technical expertise, etc.

Foreign Military Sales

- South Korea
- Australia
- Canada
- Czech Republic
- Denmark
- Slovakia

V2.0 Capabilities
(Released 29 Feb 08)

- Scale up to 30k entities (4x improvement over v1.0)
- Improved data collection tool for analytical use case
- Improved parametric data loading
- Improved terrain representations (SWA terrain with over 30k buildings, 300x300km, 250 Ultra-High Resolution Bldgs)
- Additional/improved COE behaviors (Hijack, sniper, IED emplacement, Unconventional infiltration, etc.)
- C2 stimulation (ABCS) by all entity fidelity types
- SMDC satellite models integrated

Architecture

PRODUCT LINE ARCHITECTURE FRAMEWORK (PLAF)

Architectural Applications (OneSAF System Compositions)

- Leader and Staff Training System Composition
- Seamless Training System Composition
- Force and Organizations Analysis Tool System Composition
- Test and Evaluation System Composition
- Other System Compositions
- ...

OneSAF Product Layer

System Composer | Knowledge Eng. Env. | Event Planner | Model Composer | Simulation Generator | Technical Manager | Simulation Core | Simulation Controller | C4I Adapter | Analysis & Review | Repository Manager | Maintenance Environment

OneSAF Component Layer

- System Composer Tool
- KA/KE Tools
- Military Scenario Development Environment
- Environment Database Generation Environment
- Unit Composer
- Entity Composer
- Behavior Composer
- Environment Composer
- Icon Tool
- Battlefield Enum. Tool
- Management & Control Tool (SSDE)
- Data Collection Specification Tool
- Sim. Config. & Asset Mgmt. Tool
- Federation Develop. Tool
- Performance Modeling Tool
- Network Loader Tool
- Benchmark Tool
- Unit Models
- Entity Models
- Behavior Models
- Physical Models
- Environment Models
- Management & Control Tool
- Federation Mgmt. Tool
- Stealth Tool
- Monitor & Control Services
- Translation Services
- Connect Services
- AAR
- Annotator Tool
- Model Verif. Tool
- Data Management Tool
- Information Meta-Data Tool
- S/W Eng. Environment
- CM Tool
- Defect Tool
- S/W Verif. Tool
- System Acct. Tool
- S/W Install Tool
- System Dist. Tool

OneSAF Component Support Layer

Composition Services | Environment Runtime Services | Environment Reasoning Services | GUI Services | Plan View Display | Data Collection Services | Simulation Services | Simulation Object Runtime Database | Modeling Services | System Repository Services

OneSAF Repository Component Layer

KA/KE Repository | Environment Repository | Software Repository | System Composition Repository | Military Scenario Repository | Local Exercise Environment Repository | Parametric & Initialization Repository | Simulation Output Repository

OneSAF Common Services Layer

Monitor Services | Time Services | Name Directory Services | Messaging Services | Coordinate Services | Interchange Services

Middleware Services: RTI | DIS | COE Services | WWW | JDBC/ODBC | ORB | Live Range Adapter

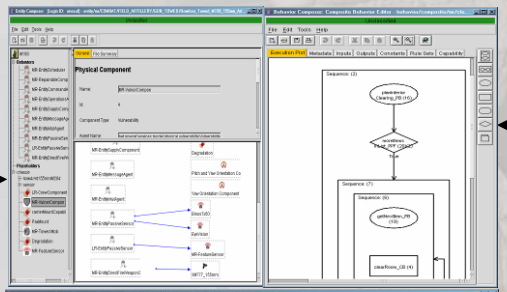
OneSAF Platform Layer

Hardware | Operating System | Network

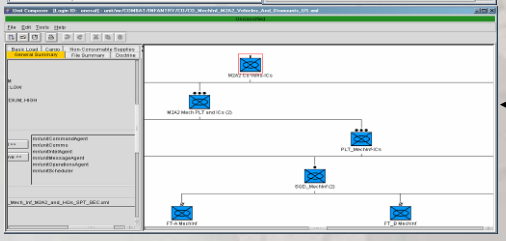
COMPOSITION TOOLKIT

Battlespace Composition

Entity Composer

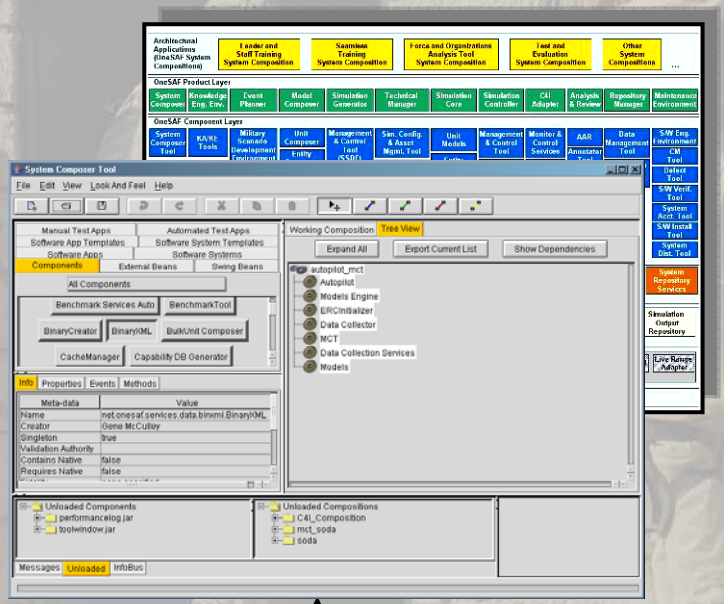


Behavior Composer



Unit Composer

System Composition

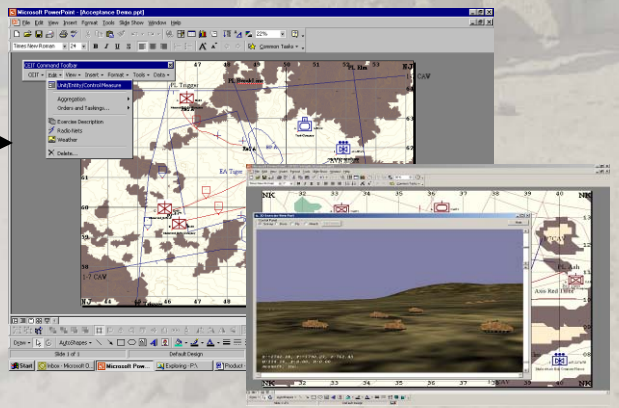


System Composer

Select only the components needed

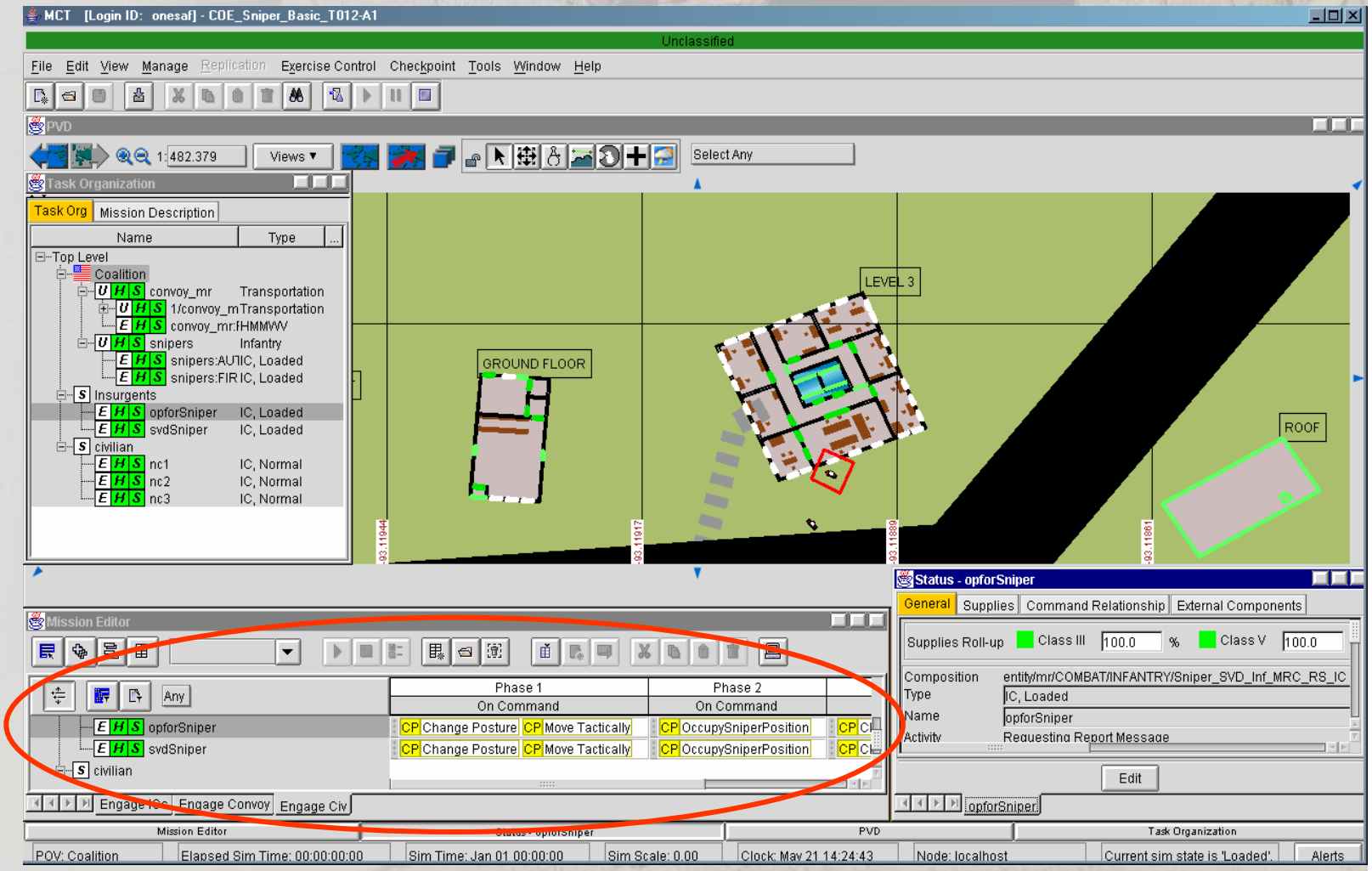
Scenario Composition

Military Scenario Development Environment



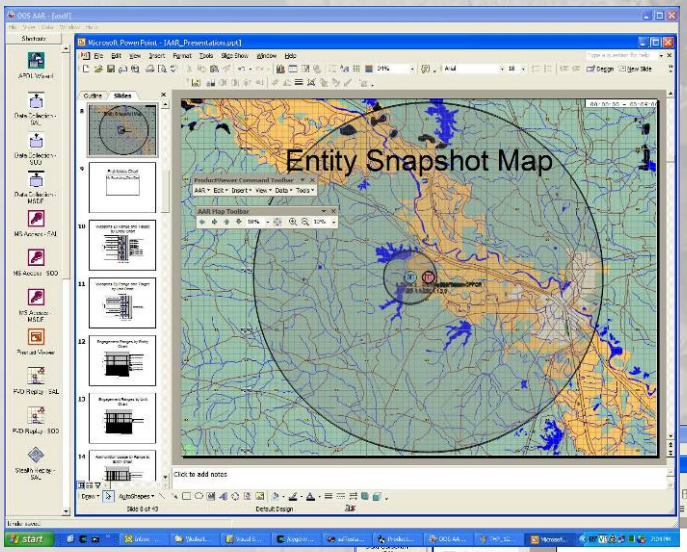
Ease of Use in MS Power Point

MANAGEMENT AND CONTROL TOOL

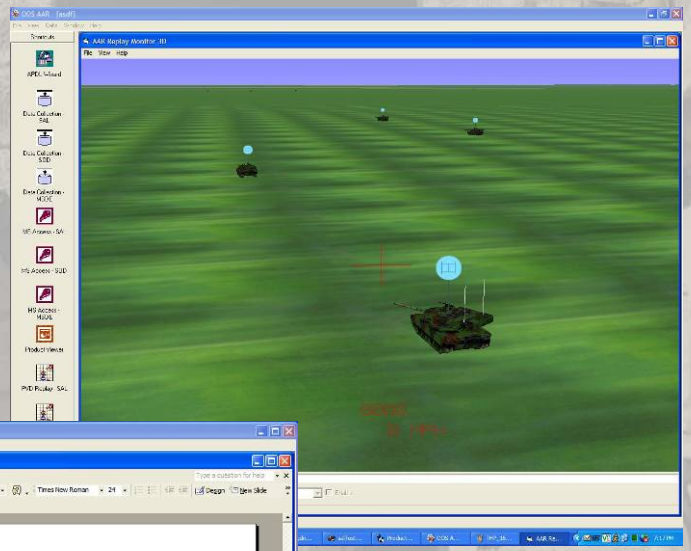


AFTER ACTION REVIEW

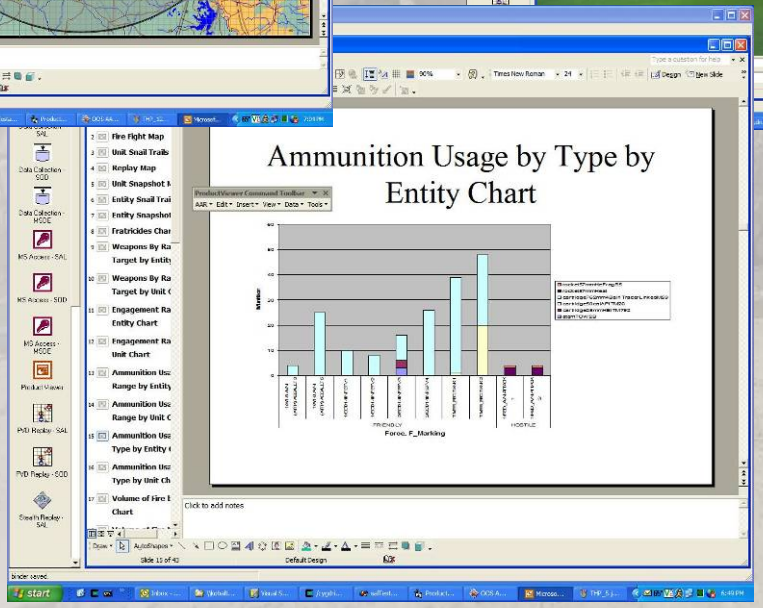
Scenario snapshots



3D viewer



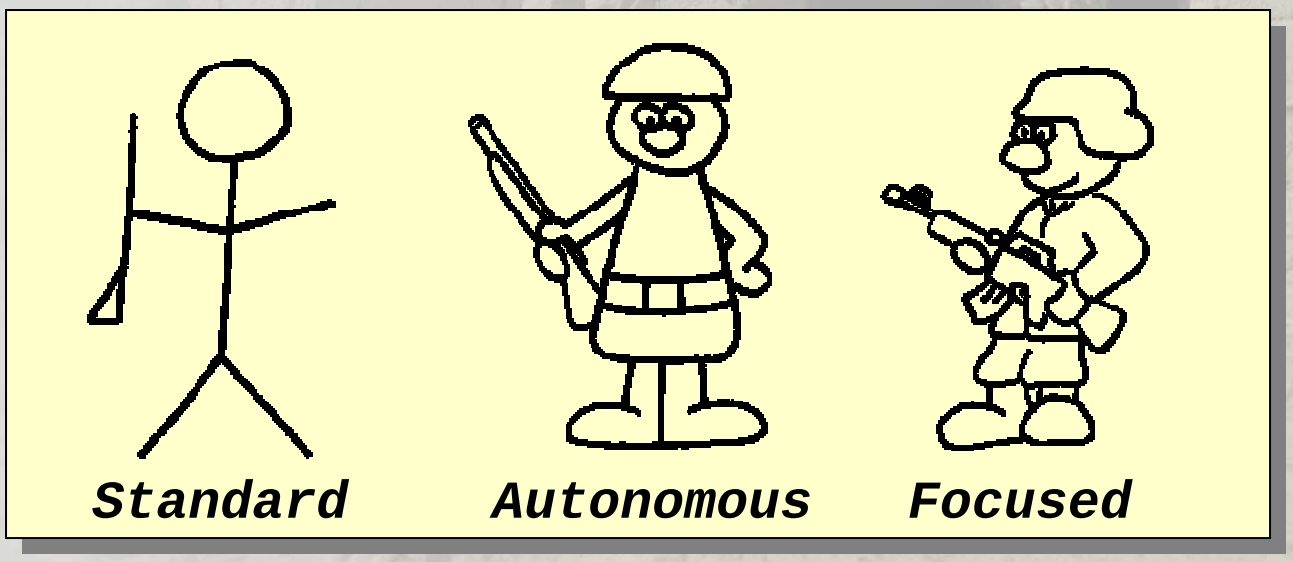
Data charts in MS Office format



Models

Multiple Levels of Resolution

- Three levels in OneSAF
  - standard, autonomous, and focused
- Interactions between entities of different levels of resolution are tested
- Allows users to “dial up” the level of resolution where it is needed



FULL RANGE OF OPERATIONS

Complete Simulation Solution

Full range of BFA systems and operations
Semi- or Fully-Automated behaviors
Multi-resolution, validated models
Multi-resolution terrain (Weather/NBC)
Ultra High Resolution Buildings
Two-way connectivity to C4I devices

Humanitarian Assistance

Resupply, Repair, Towing, Medical Treatment,
Casualty move / evacuation
Load/Unload Personnel / Supplies / Equipment

Non-Governmental & Private Volunteer Organizations

Field Mission Delegate Branch
General / Medical / Relief Work Support Branch
Construction Element
Private Security Team

Ultra-High Resolution Buildings

Advanced features - closet, elevator shaft, hallway, stair, etc.
Apertures - breach hole, door, etc.
Enhanced attribution - lighting characterization, interior wall/floor construction
Enhanced route planning within buildings - routes through apertures, line of sight through apertures
Bullets passing through walls

Urban Operations

Clear a Building
Assault a Building
Urban Sniper
Execute Urban Ambush Air
Conduct Raid
Conduct Ambush

MODELING THE CONTEMPORARY OPERATING ENVIRONMENT

Multiple sides (Up to 25)

Dynamic Asymmetric Relationships

- **Friendly**
- **Hostile**
- **Suspect**
- **Neutral**

Basic Crowd Modeling

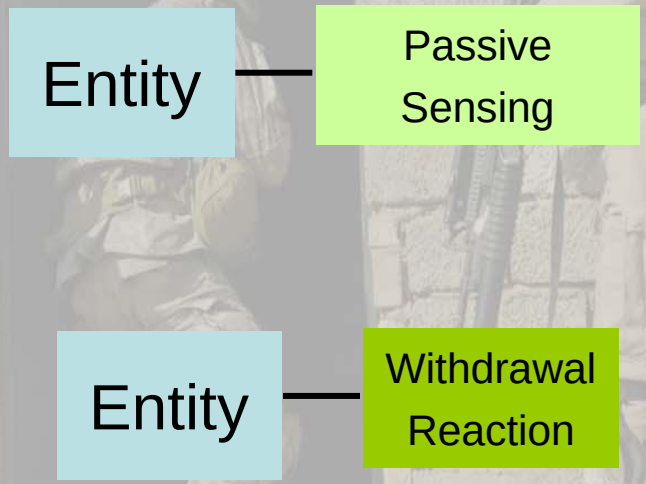
- Improvised Explosive Devices
- Improvised Obstacles in Mouse Holes
- Mouse Hole Creation
- Dynamic Side Changes
- Reduced Profile Shooting
- Detect Vehicle Borne IED
- Indirect Fire Weapons used as Direct fire weapons
- Urban Operations Medevac
- Sniper Tactics
- Penetration of Building Walls
- Conduct Raid
- Controlled Mines
- Ambush
- “Technicals”
- Shielding Tactics
- Expedient Field Fortification
- Decoys
- Rocket & Mortar Attack

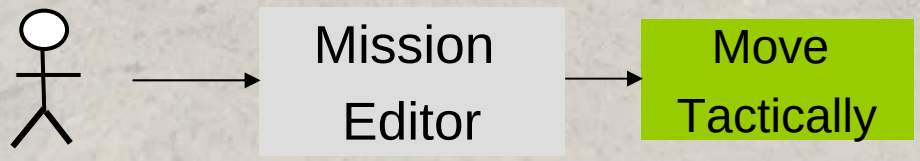
Behavior Modeling Overview

Automated Behaviors

- Typically, does not require user intervention for behavior initiation and execution.
- Commonly developed using Agent-Model pairing.
- Components are assigned to either Entity or Units.
- E.g. Passive Sensing, Direct Fire, Damage Assessment (vulnerability), etc.

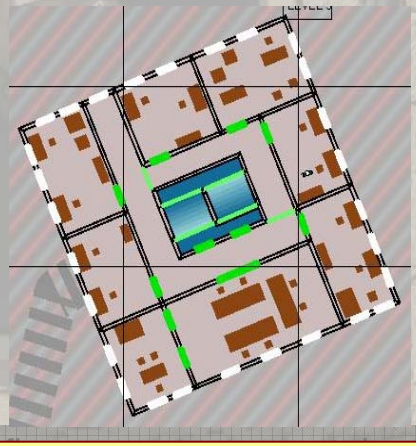
- Reactions are automated behaviors which are run as a result of situational conditions within the SAF.
- Reaction behaviors are composite behaviors, developed using the behavior composer.





SYNTHETIC NATURAL ENVIRONMENT

- Multi-resolution terrain databases
  - High resolution (1:50k),
  - Very-high resolution (1:12.5k)
- Varying levels of building fidelity
  - Medium, high, and ultra high
- Ray-trace LOS through terrain, features, and UHRB apertures
- Standardization of OTF specification and API
- Multi-resolution NBC & Obscurants
- Degradation of surfaces due to use
- Support for subterranean structures
  - Tunnels, sewers, basements, etc.
- Building damage and rubble of buildings



Ultra-High Resolution Buildings

Advanced features - balcony, closet, elevator shaft, hallway, fire escape, ramp, stair, etc.

Apertures - breach hole, door, skylight, trapdoor, etc.

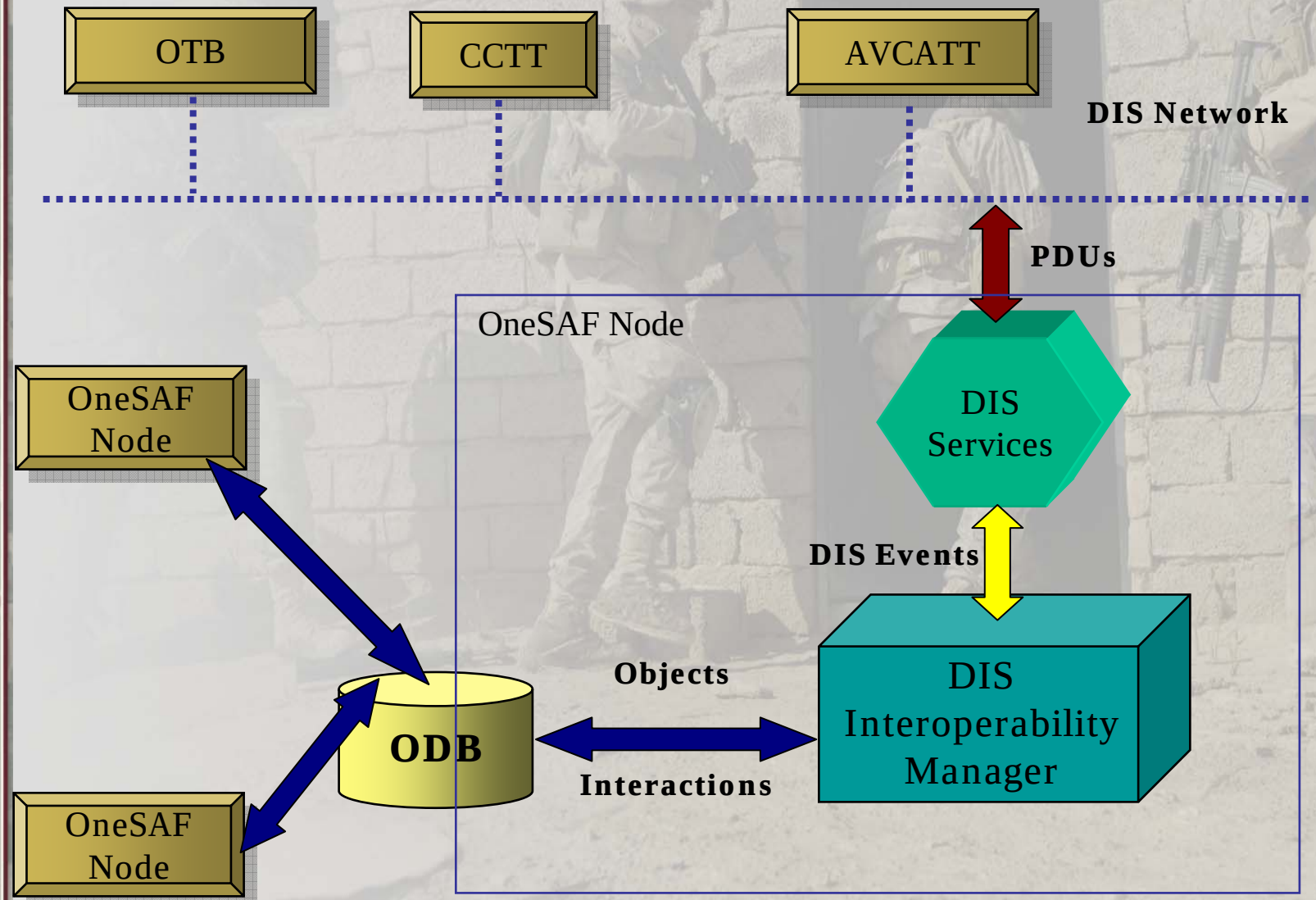
Enhanced attribution - lighting characterization, interior wall/floor construction

Enhanced route planning within buildings - routes & LOS through apertures

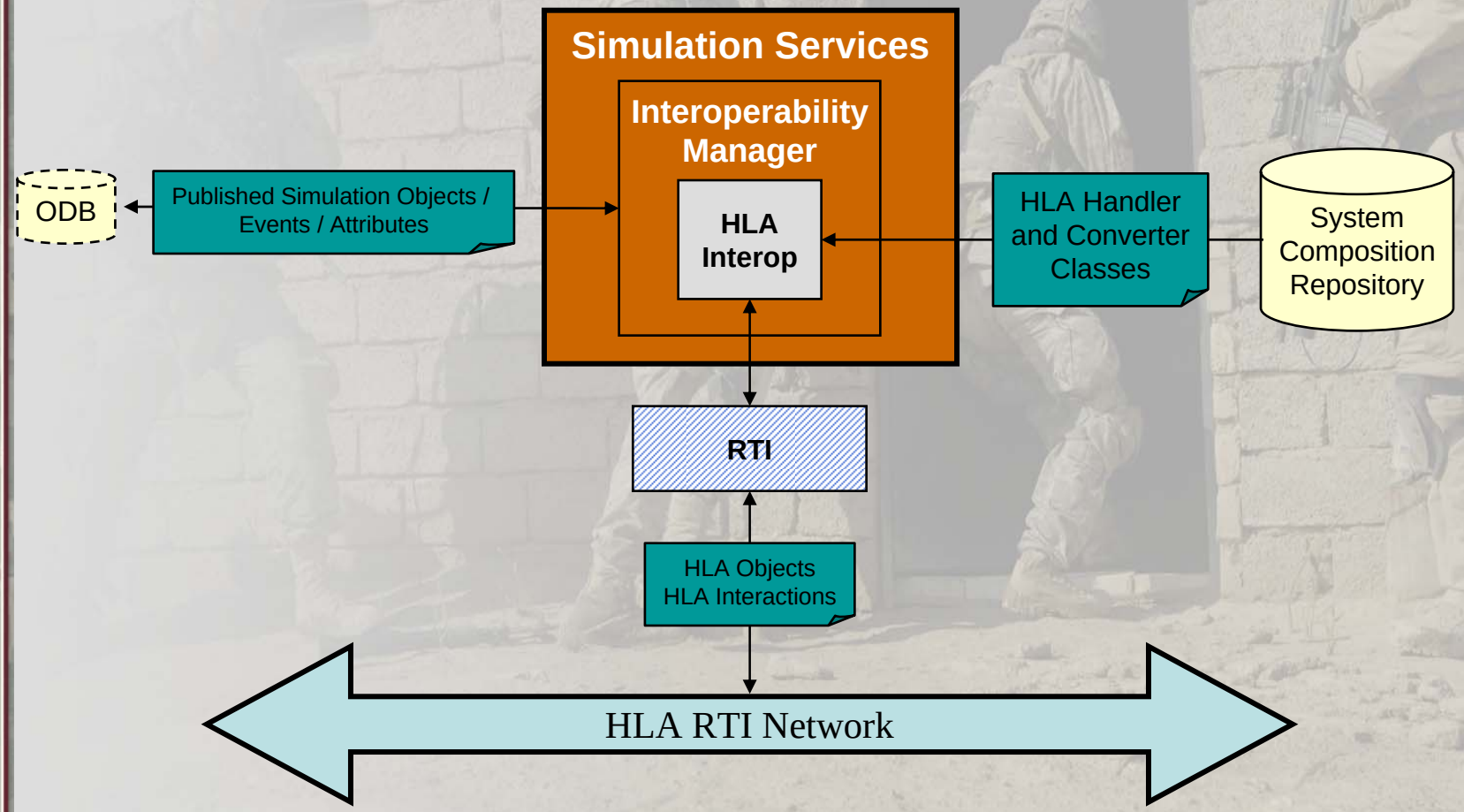
Bullets passing through walls

Interoperability

DIS

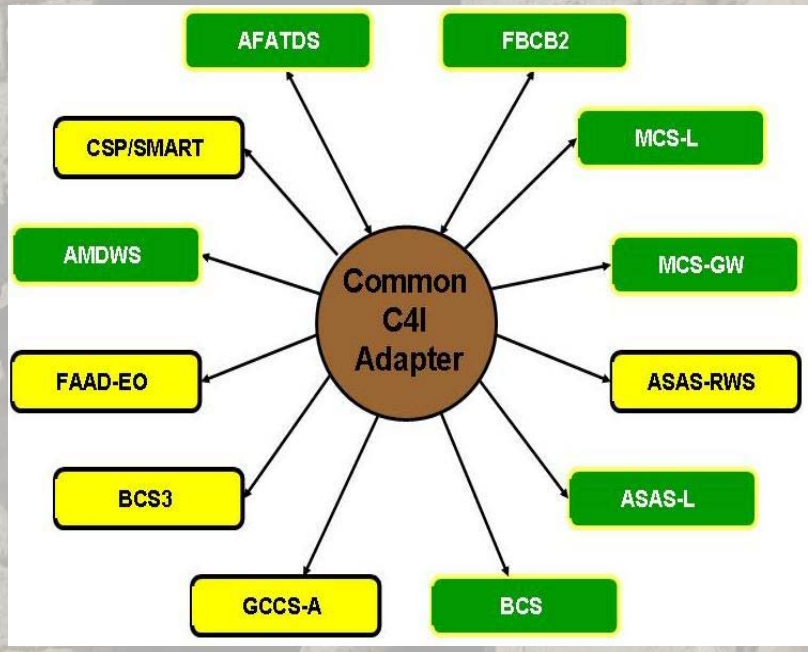

OTB
CCTT
AVCATT
DIS Network
PDUs
OneSAF Node
DIS Services
DIS Events
OneSAF Node
OneSAF Node
ODB
Objects
Interactions
DIS Interoperability Manager

HLA


Simulation Services
Interoperability Manager
HLA Interop
ODB
Published Simulation Objects / Events / Attributes
HLA Handler and Converter Classes
System Composition Repository
RTI
HLA Objects HLA Interactions
HLA RTI Network

C2 SYSTEMS INTEROPERABILITY

- OneSAF models are “C2 Aware”
  - All C2 messages are purposely sent/received by individual models as a result of simulation events
- Two way C2 interface
  - Outbound: OneSAF provides the COP for C2 devices
  - Inbound: C2 Devices affect OneSAF models and provide information to the simulation operator



Green = OneSAF Supported

OneSAF Version 1.5 C4I Supported Messages

JVMF Versions R5 (SWBI) and 6017 (SWBII)

Red: New messaging capability (NBC4, NBC5, JVMF 6017 Fire Support messaging)

AFATDS (JVMF 6017)

K01.01 Freetext
K02.01 Check Fire
K02.04 Call For Fire
K02.06 Observer Mission Update
K02.16 EOM
K02.22 Subsequent Adjust

K02.01 Check Fire
K02.04 Call For Fire
K02.06 Observer Mission Update
K02.12 On-Call Fire Command
K02.14 Message to Observer
K02.22 Subsequent Adjust

MCS-GW

K05.19 Entity Data Message (Bridge, Obstacle, Nbc1, Nbc4, Nbc5, Supply point, Spot)
K05.01 Location Report

AMDWS

F3 Track Report

MCS-WS

K01.01 Freetext
K04.02 Land Route Report
K04.03 Obstacle Report
K04.09 Bridge Report
K05.01 Location Report
K05.02 NBC1
K05.05 NBC4
K05.06 NBC5
K05.14 Situation Report

K05.17 Overlay
K05.18 MOPP Message

OneSAF

AFATDS (P11)

K01.50 Freetext
K02.01 Check Fire
K02.04 Call For Fire
K02.06 Observer Mission Update
K02.09 Mission Fired Report
K02.11 Ammunition Inventory
K02.14 Message to Observer
K02.16 EOM
K02.22 Subsequent Adjust
K02.51 Sitrep (for Location updates)

K02.01 Check Fire
K02.04 Call For Fire
K02.06 Observer Mission Update
K02.09 Mission Fired Report
K02.12 On-Call Fire Command
K02.14 Message to Observer
K02.16 End of Mission
K02.15 Fire Support Coordination Measures
K02.22 Subsequent Adjust

ASAS-L

K04.01 Spot / Salute
K05.19 Entity Data Message

K05.17 Overlay

FBCB2

K01.01 Freetext Message
K04.02 Land Route Report
K05.01 Location Report
K05.14 Situation Report
K05.19 Entity Data Message (Bridge, Obstacle, Nbc1, Supply Point, Spot)
K07.03 Logistics Report
K07.04 Personnel Status
K07.07 Medical Unit Sitrep
K07.09 Supply Point Status
K07.12 Task Management
K07.01 Medical Evacuation Request

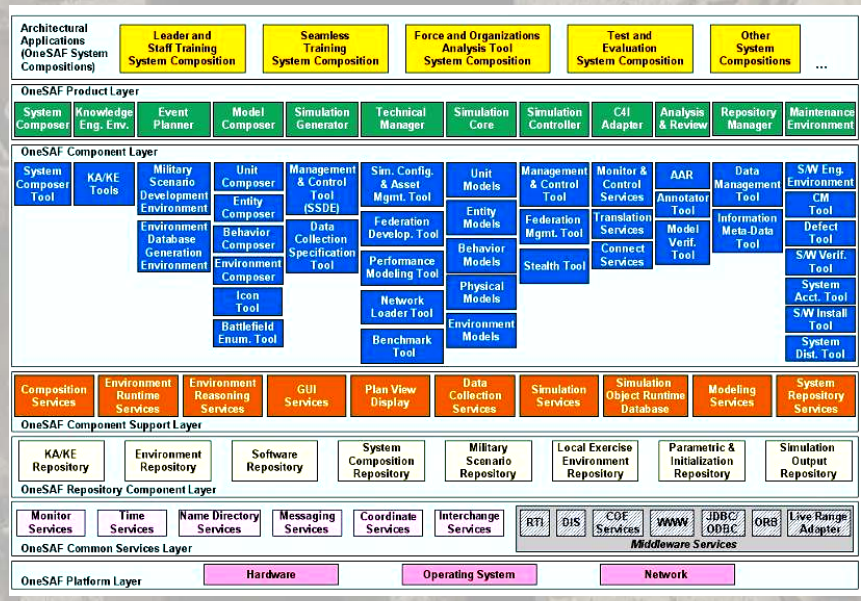
K04.03 Obstacle Report
K04.09 Bridge Report
K05.13 Threat Warning
K05.17 Overlay Message
K05.18 MOPP Message
K05.19 Entity Data Message (obstacle, target data, bridge)
K07.06 CTIL/BRIL

Standards

Emerging Standards

MSDL – Military Scenario Definition Language

Defines the language between tools & simulations to provide military scenario information to OneSAF. Currently MSDE, C2PC and CAPES interoperate with OTB & OOS using MSDL. Future efforts to include FCS C2 systems and Battlefield Mgmnt Language (BML) integration.



OTF - Objective Terrain Format

Defines the OOS Synthetic Natural Environment. Provides a common LVC environmental representation for USA simulations (CATT / AVCATT / CTIA / WARSIM / Combat XXI) and federations (ACTF / BLCSE / MATREX).

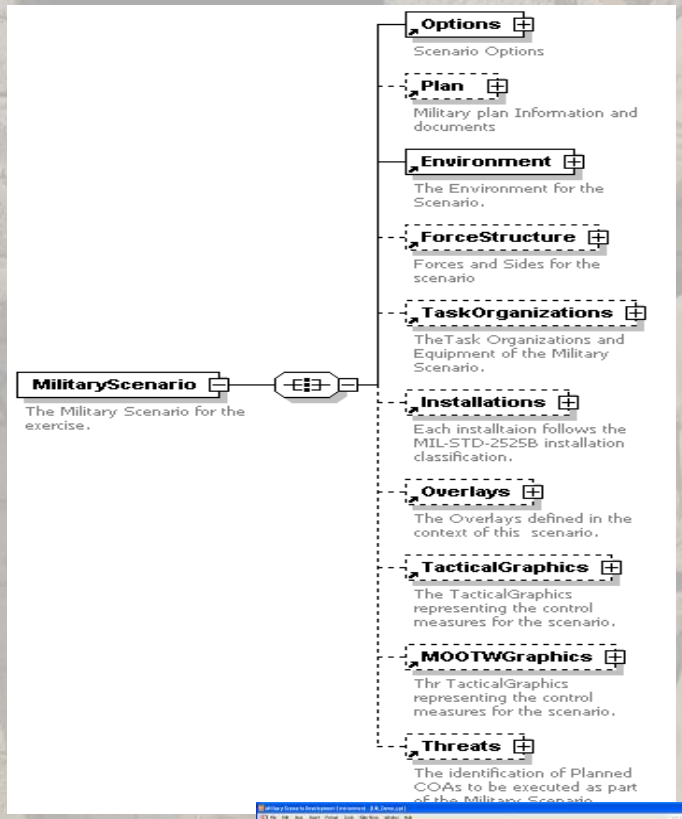
PLAF - Product Line Architecture Framework

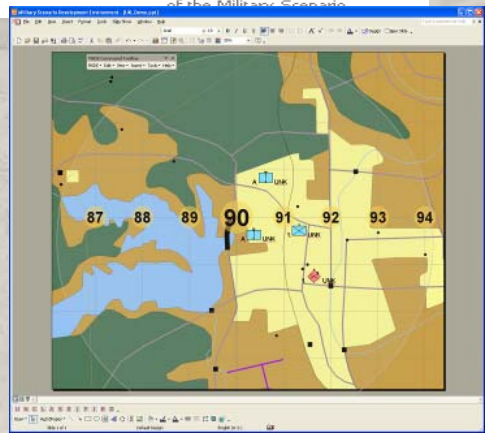
A modular, composable architecture with well defined APIs and data schemas for all components. Supporting current USA & USMC constructive & virtual simulation development.

SORD – Simulation Object Runtime Database Contains shared battlespace objects, which include platforms, units, dynamic environment objects (smoke clouds, obstacles) missions, orders, and reports. Provides ability for any SORD client to access the data in the OOS database if it has properly expressed interest for those objects.

MSDL Characteristics

- Separation of Code from Data
  - XML Schema explicitly defines allowable data types, constraints, enumerations, and hierarchical relationships
- Use of Industry Standards
  - World-Wide Web Consortium (WC3) XML
- Application Independence
  - Community wide access for military scenario development tools
  - Community wide access to existing military scenarios
- Separation of Concerns
  - Focuses on military scenario information not on application specific, exercise control specific, or other simulation initialization areas





Conclusion

OneSAF Provides Unique Opportunities

- US Army SAF / CGF for the future
  - Analysis / Research / Development
  - Live / Virtual / Constructive
- Source Code Distributed
- Extensive Documentation
- Web Site / Technical Support / Help Desk
- User and Developer Training
- A wide range of supportive tools
  - Developer / Data Collection / Interoperability
  - Scenario Development / AAR / Composers
- Leverage other developers code
  - Large Community of Interest (>150 for v1.0)