U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – SOLDIER CENTER

Intelligent, Adaptive Training in The Synthetic Training Environment

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17 MAY 2019
THE PROBLEM

"As Is"

1980s technology – limits ability to train Combined Arms operations
57 terrain formats
Concurrency challenges and not designed to meet compliancy directives
Facilities-based TADSS
High overhead and long exercise lead times
Stove pipe systems
Requires increased resources for TADSS
Cannot replicate the Operational Environment
No Joint/UA integration

1ID Danger Focus

“To Be”
Common Synthetic Environment that fully enables Combined Arms maneuver in a multi-domain environment
Dynamic one-world terrain
Software-enabled updates
Less fixed infrastructure reliance – point of need delivery
Fewer contractors, less hardware, & faster exercise design
Reconfigurable trainers
Uses ongoing commercial innovation for updates
Full replication of the Operational Environment
Joint and Unified Action (UA) integration

Simplify Process
Integration to Convergence
STE FRAMEWORK
SOLDIERS AND LEADERS - OUR ASYMMETRIC ADVANTAGE

Synthetic Training Environment (STE)

Training Management Tool (TMT)
- Big Data, Intelligent Tutors
- Training Effectiveness
- Human Dimension
  - Plan
  - Prepare*
  - Execute
  - Assess
*Includes OE/Red Force

Authoritative Data Sources
- For example, Army Training Information System (ATIS)

Common Synthetic Environment (CSE)

Training Simulation Software (TSS)
- "the engine"
- Scale & Entity Count
- Open Software
- PoN / Network
- Virtual Humans / AI

Virtual Semi-Immersive User Interface and Hardware
- For example, VBS3

Virtual Immersive User Interface and Hardware
- Mixed Reality
- Haptics
- Physiological Affects
- Simulator Sickness
- Reconfigurable
- Transportable

Staff Training User Interface and Hardware
- For example, JLCCCTC

Mission Command Information Systems (MCIS)

Temporary Interface to Legacy Systems (LVC-IA)

Global Terrain
- Standard, Shareable Geospatial Foundation

Live TADSS
- For example, HITS, MILES

Integrated Training Systems (TSS)
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**ONE WORLD TERRAIN**

- Cloud-based service that delivers a common synthetic representation of the whole Earth
- Includes air, land (subterranean), sea (undersea), space (up to geosynchronous), and cyber domains
- The ability to export 3D mesh-based terrain to 2D vector- and raster-based terrain systems
- Includes dynamic terrain capabilities
RECONFIGURABLE VIRTUAL COLLECTIVE TRAINERS

**Future Virtual Interfaces**
Software-centric, Capitalize on Commercial Technology, Reconfigurable, Low Sustainment $$, One World Terrain, Common Synthetic Environment, Scalable Interfaces – Point of Need, Responsive to Updates – Most will take place with software changes, Transportable, OFP for AVN Platforms

**Minimal Hardware – Virtual Reality**

**Common One World Terrain Virtual Environment**

**High Fidelity Interactive Virtual Models**
Soldier/Squad Virtual Trainer

S/SVT Core:
- Close Combat, WSD, JFT, and Use of Force training requirements into one capability
- Software Centric
- Transportable
- Supports Simulated Devices

S/SVT Primary Deliverables:
- Usability: Soldier enabled training with an adaptive learning capability
- Tailorable: Capability to train multiple functions with the same platform
- Scalability: Capability to simultaneously train multiple Soldiers
- Reduced WCLS costs: Soldier is the Trainer
- Transportable: Point of Need
- Adaptive to new systems and OE
- Replicates operational complexity & uncertainty
- Concurrent with current/future operational systems
- Links training results to training repository
- Acceptable Form, Fit, Function (O3), and Performance

S/SVT Configurations:
- Stand Alone
- Networked
- Integrated

S/SVT Provides Four Simulated Military Equipment (SME) Training Capabilities:
- Close Combat Squad Training (CCST)
  - Dismounted Squad Collective Task/Battle Drills
  - Multi-Domain Battle Field
  - Any Operating Environment (WUT, Urban, etc)
- Weapon Skill Development (WSD)
  - Rifle Marksmanship
  - Dismounted Crew Served Training/Qualification
  - Table II Requirement for IWTS
- Joint Fires Training (JFT)
  - JFO Qualification/Certification
  - Joint Fires Training
  - Indirect Fires Training
- Use of Force (UoF)
  - Lethal and non-lethal interactions
  - Meets DOD regulatory requirements
  - JNLE Training at Homestation
INTEGRATED VISUAL AUGMENTATION SYSTEM (IVAS)

**FIGHT**
- "LIMITED INTEGRATION" Limited integration of lethality and mobility capabilities constrain the warfighter in combat.
- "INTEGRATION OF HEAD-BODY-WEAPON" Detection, targeting, engagements, and AI that match the speed of war. "Providing Soldier/squad 10X capability."

**REHEARSE**
- "LIMITED WALKTHROUGHS" Limited representative terrain, structures, and locations.
- "UNLIMITED REHEARSALS" Infinite availability of identical terrain, structures, and locations. "A squad close combat Simulator".

**TRAIN**
- "TRAIN or FIGHT" Different operational weapons and equipment.
- "TRAIN AS YOU FIGHT" Identical training / operational weapons and equipment in any terrain. "25 Bloodless Battles".
• An intuitive easy to use capability that allows Commanders and Exercises Developers to efficiently plan, prepare, execute, and assess training
• A tool that automatically retrieves and transforms authoritative data
• Automatically generate and populate simulation inputs (databases)
• Provides intelligent tutor capabilities
• Provides methodologies to assess training effectiveness
• Interface with all virtual, constructive and live training systems
TMT CORE CAPABILITIES

TMT Phase
- PLAN
- PREPARE
- TRAINING EXECUTION
- ASSESS

Capability
- Tailored Scenario Generation
- Real-time Feedback and Adaptation
- Rapid Assessment and AAR

Supporting Tech.
- Automated Performance Assessment for Individual and Teams
- Automated Feedback and AAR for Individuals and Teams
- Intelligent, Adaptive Training for Individuals and Teams
AUTOMATED PERFORMANCE ASSESSMENT FOR TEAMS

What is it & why does it matter?
STE’s team performance assessments need to be GENERALIZABLE.
Teamwork assessments need to be automatically collected during scenario execution and diagnosed in real time.
Event-based automated teamwork assessments increase quantity, quality and type of feedback, AAR, and training adaptation possible.

What is available from govt/industry/academia?
Current collective training assessments for simulations are SUBJECTIVE, GO/NO-GO hand-held checklists.
These limit the training effectiveness of AARs that can improve team performance, and tracking/documenting training effectiveness of simulations over time.
Drives up the cost of labor for Observer/Controllers to run the assessments.

What are the S&T challenges?
Natural Language Processing for Team Assessments.
Methods for developing valid generalizable assessments in complex scenarios developed with SME input.
Rapidly contextualizing interaction and communication data within a set of scenario tasks/conditions/standards.
Tracking teams across scenarios and domain spaces through persistent modeling techniques.
Deriving data sources that inform team communication protocols void of natural language (gestures and signaling).
AUTOMATED FEEDBACK AND AAR FOR TEAMS

What is it & why does it matter?
Providing data that is too raw or granular does not support learning. Assessment entails interpreting data to learners/trainees so that they understand their mistakes through effective AARs.

Automated real-time feedback for teams with little or no experience and objective, validated performance assessment to enable rapid AAR at any point of need.

Enables rapid identification of key scenario events relevant to conduct the AAR.

What is available from govt/industry/academia?
Current AAR systems can automatically generate Powerpoint charts and provide recordings (with playback/pause) that can be bookmarked by SME’s.

Data/Metrics require significant work to analyze and summarize.

Systems lack an automated objective team assessment capability.

What are the S&T challenges?
Data Visualization for Team Performance

Personalizing feedback across the roles and tasks performed within a team structure

Tailoring feedback based on team skill acquisition over time.

Establishing a pedagogical strategy for managing real-time instructional support versus AAR and post-exercise remediation.
INTELLIGENT ADAPTIVE TRAINING FOR TEAMS

What is it & why does it matter?
The ability to automatically adapt training difficulty, provide prompts, recommend remedial training to enable teams to achieve training goals effectively and efficiently.

Current approaches to adapting collective training events require a great deal of preparation and control by human trainers. This level of support is available at large simulation training centers. AI based adaptive training will enable STE to have this capability at any point of need.

What is available from govt/industry/academia?
Individual tutoring systems for specific to domains/skills. These are very expensive to build.
Few team tutors exist (e.g., collaborative problem solving).
Only rudimentary tutoring systems exist for military teams.

What are the S&T challenges?
Creation of domain independent tutoring systems that are flexible enough to work across team types, sizes, and missions.

Pedagogical models that can determine optimal feedback and interventions at both individual and team levels to produce effective training.

Selecting an optimal training strategy and scenario based on team needs (varying based on echelon structure).
RESEARCH GOALS

- Visualization of real-time team performance for exercise control
- Visualization of projected training outcomes
- Visualization of battlefield effects (e.g., cyber, kinetic, non-kinetic) on physical, social, cultural, etc. elements of OWT.
- Tools for rapid creation of AAR
- Management of information complexity during execution
- Exercise control tools/interfaces for training managers
- Visualization of projected impact of scenario adaptation on training outcomes.
- Data requirements for TSS to support TMT analysis, visualization, feedback and scenario adaptation
- TMT TESTBED
- MR Visualization
- Adaptive Training
- Policies for automating real-time scenario adaptation/injects
- Techniques for automating assessments for Armored PLTs
- Techniques for automating assessments for BN-BDE CP teams
- Techniques for automating assessments for dismounted squads
- NLP for team verbal comms
- Policies for automated feedback to individuals vs teams
- Automated AAR for diverse teams/missions
- xAPI formats for reporting Team performance
- Persistent competency frameworks for military teams
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Questions?