U.S. ARMY

DEVCOM SOLDIER CENTER

U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND SOLDIER CENTER

DEVCOM Soldier Center
SFC Paul Ray Smith Simulation and Training Technology Center

TSIS Presentation – 22 June 2023

PR2023_39440

AGENDA

- Portfolio Overview
- Live Training
- Cyberspace and Information Warfare
- Simulation Architecture
- Training Effectiveness
- Medical Simulation and Training
- DEVCOM-SC BAA

MISSION, VISION, ORGANIZATION, STAKEHOLDERS AND FUNDING

MISSION

Discover, Develop, and ***Transition*** Innovative Simulation and Training Technology to Maximize Soldier Effectiveness and Warfighter Readiness.

VISION

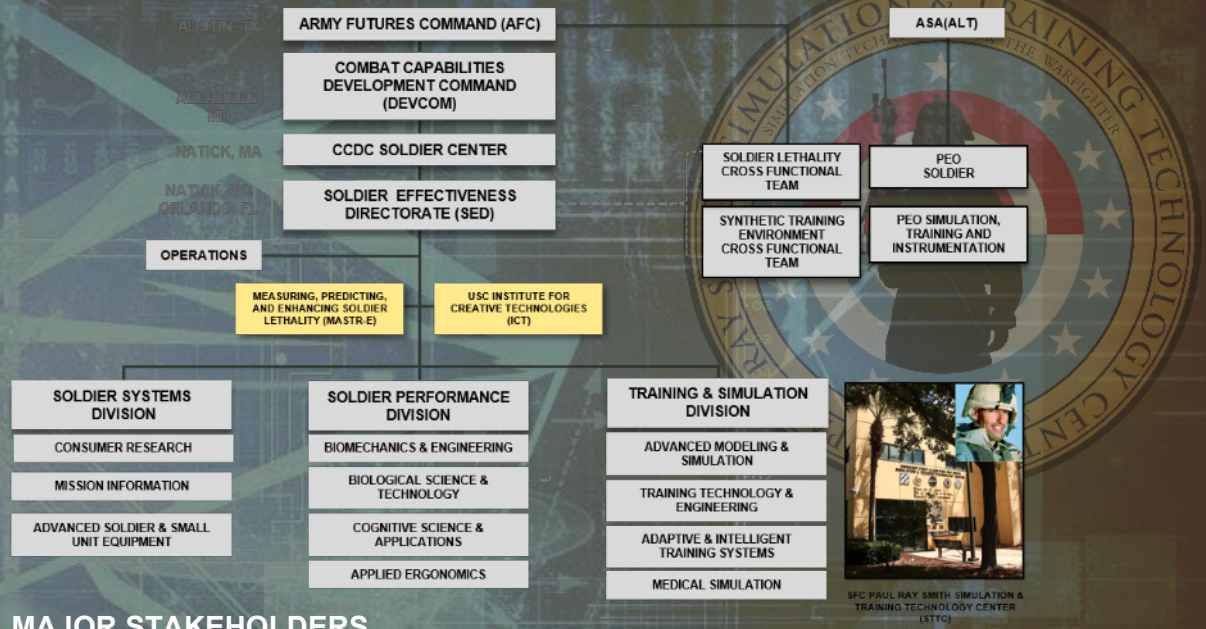
World Class Experts in the Science of Modeling, Simulation, and Training Enabling the Acquisition and Fielding of Effective Solutions for the Warfighter.

Live Training "e-Bullet"

Medical Simulations

Virtual Humans

Augmented Reality



MAJOR STAKEHOLDERS

- Synthetic Training Environment Cross Functional Team (STE CFT)
- Program Executive Office Simulation Training & Instrumentation (PEO STRI)
- Combined Arms Center – Training (CAC-T)
- U.S. Army Medical Research & Development Command (USAMRDC)
- Defense Advanced Research Project Agency (DARPA)
- Army Modeling & Simulation Office (AMSO) and all 6 Army M&S Communities

FUNDING

- ~ $52M Core Mission Funds (6.2 and 6.3)
- ~ $50M Customer Funds

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S&T INVESTMENT STRATEGY

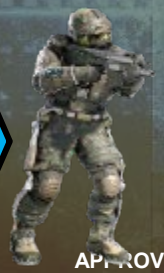
Simulation and Training S&T Investments

Near Term (Present-2023)	Mid Term (2023-2028)	Far Term (2028-2035)
• One World Terrain (OWT) • Training Simulation Software (TSS) • Training Management Tools (TMT) • Soldier integrated Virtual Trainer (SiVT/SVT)	• Cyberspace Effects • Live Training (Terrain & OH Reduction) • Simulation Architecture (includes NGC) • Training Effectiveness • Medical	• Information Warfare • Live Training (Adv. Weapon Systems) • Synthetic Entity Behaviors • MDO Competency-based Training • Training Overhead Reduction

Pre-MDO → 2030 Force → 2040 Force

Continue leveraging POM Planning Process to maintain transparency and priorities across ***S&T***, ***User*** and ***Transition Partner*** Communities

Modernize Virtual Training



Seamless L,V,C Training

NEW FY23 S&T EFFORTS

Area	S&T Effort	2023	2024	2025	2026	2027	2028	2029
Live	Reducing Computational Overhead for Live Training	6.3						
	Digital Terrain for Live Training Engagements	6.2				6.3		
	Optimized Terrain Processing in Constrained Environments	6.2				6.3		
	Real-Time Synthetic Terrain Effects	6.2				6.3		
Cyberspace	Synthetic Cyberspace Effects for Training	6.3						
	Information Environment Simulation for Training	6.2					6.3	
Simulation Architecture	Dynamic Synthetic Behavior Generation	6.2					6.3	
	Automated Simulation Management	6.2				6.3		
Training Effectiveness	Competency Based Training for MDO	6.2					6.3	
Med. Sims	Virtual Training for Prolonged Patient Care	6.2					6.3	
	Physiology Engine for Prolonged Care		6.2					
	Live Training for Prolonged Care					6.2		

REDUCING COMPUTATIONAL OVERHEAD FOR LIVE TRAINING

Problem Statement

Transition away from laser-based weapon engagement simulators will most likely require a geometric pairing component. To be effective, this capability must have performance sufficient to realistically simulate weapon ballistics, terminal effects, and time-of-flight, yet simultaneously, must be low-cost, light-weight, and have a battery life that meets STE-LTS program requirements.

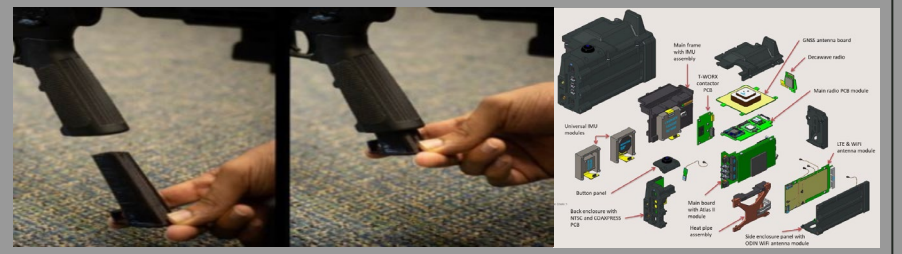
What is the Impact of Research?

Government-owned component- and subsystem-level software and hardware at TRL6 that provide impactful capabilities for integration with new STE-LTS training systems.

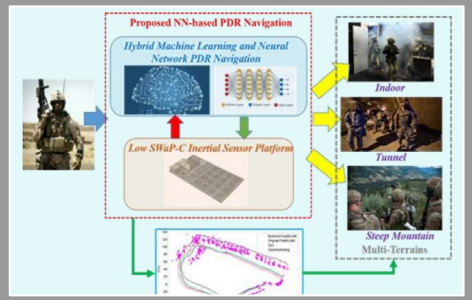
What are the Research Goals?

- **Weapon Orientation**: 1.5 MoA, battery life ≥ 24 hrs (T)/72 hrs (O), calculation latency ≤ 300msec, and at a unit cost ≤ $2K
- **Dismount A-PNT**: Position error ≤ 0.2% over distance travelled (e.g. 20cm error over 1km)
- **Cognitive Wireless Network**: 5 msec latency, reduction of back haul bandwidth to data center by 480X, support an Augmented Reality display frame rate of ≥ 90fps

Weapon Orientation



GPS-degraded Tracking



Cognitive Networks

DIGITAL TERRAIN FOR LIVE TRAINING ENGAGEMENTS

Problem Statement

Current Army capability lacks the resolution and accuracy of elevations for digital terrain and features – including building exteriors and trees – to fully support realistic and precise simulation of munition impacts and dynamic updates to the digital terrain for the Live training environment.

What is the Impact of Research?

Terrain and feature data that: are based on high-resolution data; provide vertical accuracy and error bounds at the established baseline level or better; reflect dynamic changes; and can be transmitted to constrained devices.

What are the Research Goals?

- Define the baseline for vertical resolution and accuracy required for live training use cases and objectives
- Provide terrain and feature data generation workflow that meets the required resolution and accuracy for live training.

OPTIMIZED TERRAIN PROCESSING IN CONSTRAINED ENVIRONMENT

Problem Statement

Army is unable to realize full support for real-time Live training, because the size and complexity of high-resolution terrain data can exceed in-the-field mobile computing networking resources and capabilities. Live training requires the ability to automatically adapt to constrained computing conditions – efficiently managing, wirelessly transferring, and locally hosting high-resolution terrain data and incremental updates.

What is the Impact of Research?

Compression/reduction/filtering of terrain features and transmitting terrain shall not impact accuracy and shall retain feature positions/elevations at the established baseline level or better resolution.

What are the Research Goals?

- Provide design approaches for practical cases that depend on real-time terrain data transmission through constrained networks
- Implement the appropriate algorithms, services, and workflow to support runtime-specific optimizations.
- Analyze and select a suitable visualization/simulation engine to demonstrate dynamic terrain updates

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REAL-TIME SYNTHETIC TERRAIN EFFECTS

Problem Statement

Army Live training environment lacks accurate depiction and visualization of munition effects on select terrain features tied to Commander's ability to tailor conditions for training objectives.

What is the Impact of Research?

Commander can customize local terrain/features to meet specific training objectives; can inject (turn on/off) specific and accurate physics-based weapons effects against targets of interest; can modify terrain features to meet specific training objectives; and can visualize accurate weapons effects.

What are the Research Goals?

- Provide enhanced visual and tactical effects of munition impacts on terrain and features critical to the Commander's training objectives.
- Enable Commander's ability to customize (dial up or down) terrain content to support desired training objectives.

SYNTHETIC CYBERSPACE EFFECTS FOR TRAINING

Problem Statement

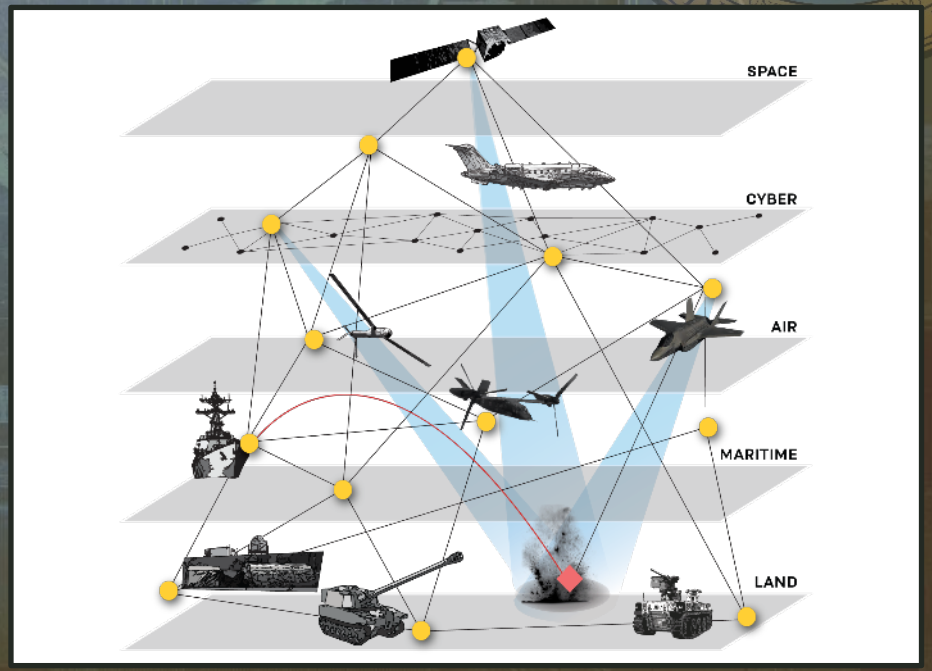
Realistic kinetic and non-kinetic effects of Cyberspace Electromagnetic Activities (CEMA) and the information environment for collective training do not exist.

What is the Impact of Research?

Elimination of white-carded cyberspace effects to provide a holistic representation of the information environment for training. Simulates complexity of Multi-Domain Operations (MDO) for the Army.

What are the Research Goals?

Represent cyber environments, electromagnetic spectrum, and space / Positioning, Navigation, Timing (PNT) devices, events, and effects at appropriate fidelity for MDO.



Researching ways to represent the cyberspace domain its interactions with all other domains and dimensions of the modern operational environment.

INFORMATION ENVIRONMENT SIMULATION FOR TRAINING

Problem Statement

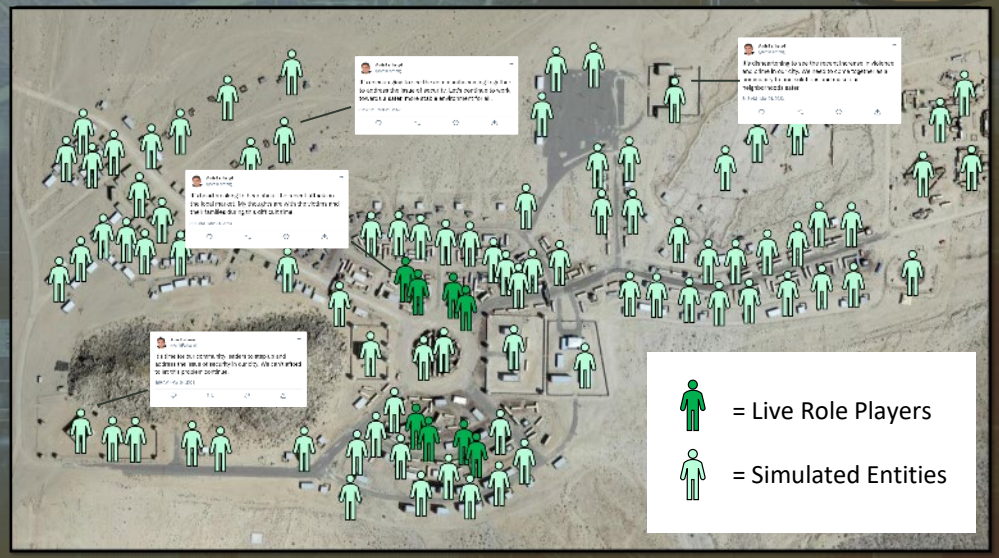
Realistic PMESII-PT models necessary to train Information Warfare (IW) by representing effects in and through cyberspace do not exist.

What are the Research Goals?

- Conduct front-end analysis to generate validated list of requirements.
- Identify emerging technologies that can support requirements and gaps to focus S&T efforts.

What is the Impact of Research?

Ability to realistically stimulate IW training audience during collective training. Simulates complexity of Multi-Domain Operations (MDO) for the Army.



Researching ways to create synthetic populations to augment live civilian role players and generate realistic and dynamic content in the information environment during exercise execution.

PMESII-PT: Political, Military, Economic, Social, Information, Infrastructure, Physical environment, and Time variables that make up the Operational Environment (OE).

DYNAMIC SYNTHETIC BEHAVIOR GENERATION

Problem Statement

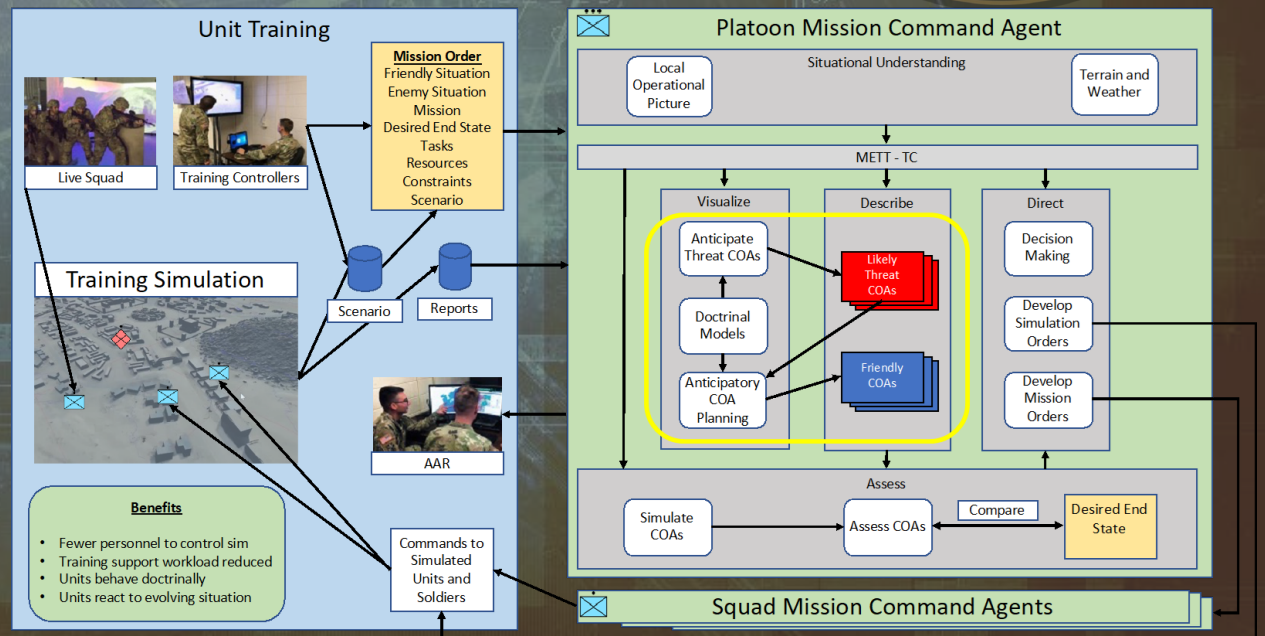
Simulated forces are primarily scripted with relatively limited automated behaviors lacking the dynamism required to support complex simulation use cases.

What are the Research Goals?

Design and develop technologies that enable fully autonomous simulation forces (Artificial Intelligence [AI] - enabled), representing Opposing Forces (OPFOR) and Blue Forces (BLUFOR), with broad applicability.

What is the Impact of Research?

Reduced need for personnel to control entities during simulation exercises, decreased authoring time of models of varying degree of difficulty, simulation agents that have explainable goals for behavior and can replicate behaviors observed in the field, and increased percentage of military representations supported by AI-enabled simulated forces.



AAR: After Action Review
COA: Course of Action

METT-TC: Mission, Enemy, Terrain & Weather, Troops, Time Available, and Civil Considerations

AUTOMATED SIMULATION MANAGEMENT

Problem Statement

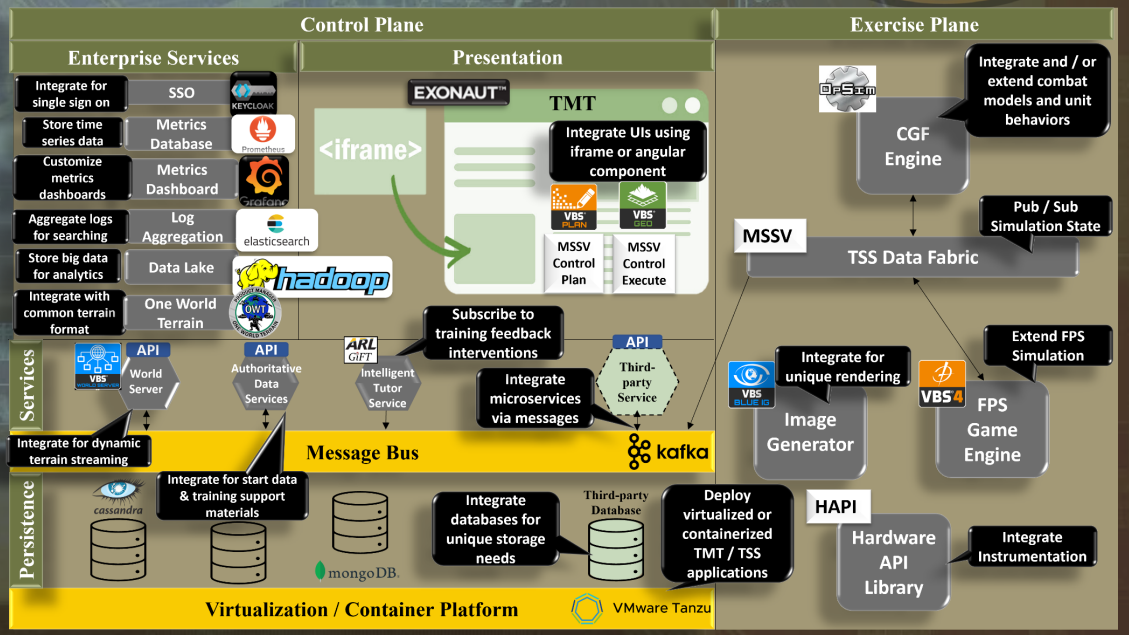
Current simulation environments are traditionally executed with many unnecessary components loaded at runtime while having limited fault tolerance during event execution.

What are the Research Goals?

Design and demonstrate an automated simulation execution architecture based on the use case, simulation scenario, hardware resources, and target user interfaces required for each simulation event.

What is the Impact of Research?

Provide methods and means for machine understanding of simulation components and architectures to support configuration and deployment, fault tolerance during simulation execution, and the linkage of use cases, scenarios, and user interfaces to available simulation components.

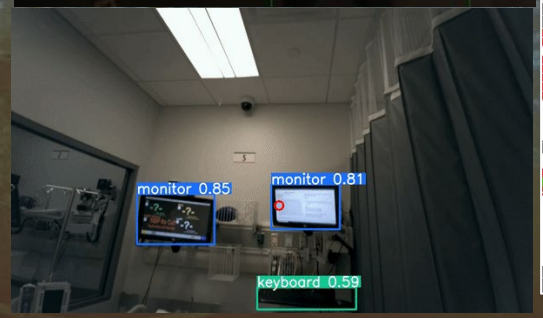


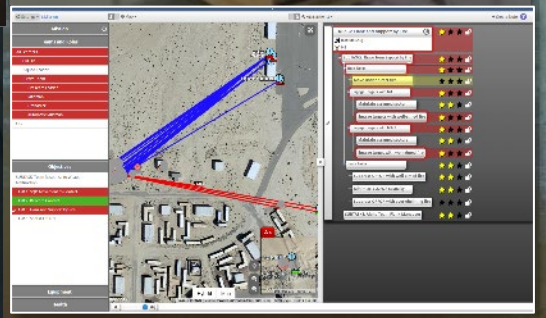
Example: Synthetic Training Environment Information System (STE-IS) Reference Architecture

COMPETENCY BASED TRAINING FOR MULTI-DOMAIN OPERATIONS (MDO)

Problem Statement

- Training data is rarely stored
- Government lacks best practices for collection, management, retention and analysis of data
- Army relies heavily on subjective human assessments to evaluate training performance and longitudinal soldier proficiency and unit readiness
- Developing content and assessments to drive adaptive training is burdensome (i.e., time and cost)





What are the Research Goals?

- **DIGITIZE:** Develop extensible MDO Competency Framework to inform data collection, tracking and readiness projections
- **ASSESS:** Mature automated assessments and adaptive instructional services for critical MDO skillsets
- **DESIGN:** Create automated scenario-generation and coaching capability aligned to MDO tasks and competency frameworks
- **MODEL:** Model team and Soldier competency development across synthetic training experiences
- **SCALE:** Test data capture and modeling techniques across institutional, operational and joint coalition learning environments

What is the Impact of Research?

- Accelerated mastery of MDO mission sets through AI-guided deliberate practice
- Reductions to the time and cost needed to deliver collective training in synthetic environments.
- Personalized training based on objective measures of readiness and team characteristics

SENSE OF TOUCH FOR PATIENT CARE

Problem Statement

What is the Capability Gap Army currently has that requires this research? AMEDD Director of Simulation CBA's 5, 6 and 8
5 – "operational realism"
6 – "physiological and behavioral symptoms"
8 – "variety and severity"

What is the Impact of Research?

Provide the ability to stimulate tactile feedback realistically in multiple modalities

What are the Research Goals?

High-fidelity tactile feedback; approaches include:

- Gloves
- Surrogate devices
- Tissue characterization
- Haptics "modules" (high fidelity simulated tissue in otherwise low-fidelity manikin)
- Nanomaterials (FY24)

PERFORMANCE DETECTION AND EVALUATION FOR PATIENT CARE

Problem Statement

What is the Capability Gap Army currently has that requires this research? CBA 1, 3 and 4
1 – “standard training objectives”
3 – “resources to train required throughput”
4 – “evaluators to support throughput”

What are the Research Goals?

- Real time processing to support on demand AARs
- Evaluate consistency of fNIRS in determining skill level
- Define objective measures that identify level of medical expertise
- Deliver instructor tools that improve skill assessments

What is the Impact of Research?

Provide the capability to objectively measure skill and knowledge, suggest remediation, indicate competency, and predict future performance.

SMART SURROGATES FOR PATIENT CARE

Problem Statement

What is the Capability Gap Army currently has that requires this research? CBA 1, 3 and 4
1 – “standard training objectives”
3 – “resources to train required throughput”
4 – “evaluators to support throughput”

What are the Research Goals?

- Haptics-enhanced training for standalone or STE medical training
- Tourniquet first, extending to other Tactical Combat Casualty Care (TC3) interventions
- Dynamic Wounds Integration
- Integrate with STE LTS and future TES (open source)
- Smart moulage and trauma shirt

What is the Impact of Research?

Capability to practice medical skills and pass data to large-scale LVC or STE-like training event without reliance on human patient simulators or patient actors.

HOW TO WORK WITH STTC?

Submit to our BAA!!

SAM.gov

Broad Agency Announcement for Basic and Applied Research at the:

US Army Combat Capabilities Development Command - Soldier Center

BAA Details

- Notice ID: W911QY20R0022
- Section F: Simulation and Training Technology
  - Embedded Training (ET)
  - Live Training Simulation of Tactical Weapon System Lethality
  - Medical Simulation and Training
  - Advanced Interactive Simulation
  - Cyberwarfare for Training
  - Adaptive Instructional Systems
  - Battlespace Visualization and Interaction
  - Synthetic Environments
  - Dismounted Soldier Research

TECHNICAL POCS

LIVE

Mr. Travis Hillyer - travis.r.hillyer2.civ@army.mil

- Reducing Computational Overhead for Live Training

Mr. Clay Burford - clayton.w.burford.civ@army.mil

- Digital Terrain for Live Training Engagements -
- Optimized Terrain Processing in Constrained Environments
- Real-Time Synthetic Terrain Effects

CYBERSPACE

Mr. Allen Geddes - james.a.geddes2.civ@army.mil

- Synthetic Cyberspace Effects for Training
- Information Environment Simulation for Training

SIMULATION ARCHITECTURE

Mr. Chris McGroarty - christopher.j.mcgroarty.civ@army.mil

- Dynamic Synthetic Behavior Generation
- Automated Simulation Management

TRAINING EFFECTIVENESS

Dr. Ben Goldberg - benjamin.s.goldberg.civ@army.mil

- Competency Based Training for MDO

MEDICAL SIMULATIONS

Dr. Beth Pettitt - merry.b.pettitt.civ@army.mil

- Virtual Training for Prolonged Patient Care
- Physiology Engine for Prolonged Care
- Live Training for Prolonged Care

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