U.S. ARMY

DEVCOM SOLDIER CENTER

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

**Sensored Soldier at the Tactical Edge**

**20 JUNE 2023**

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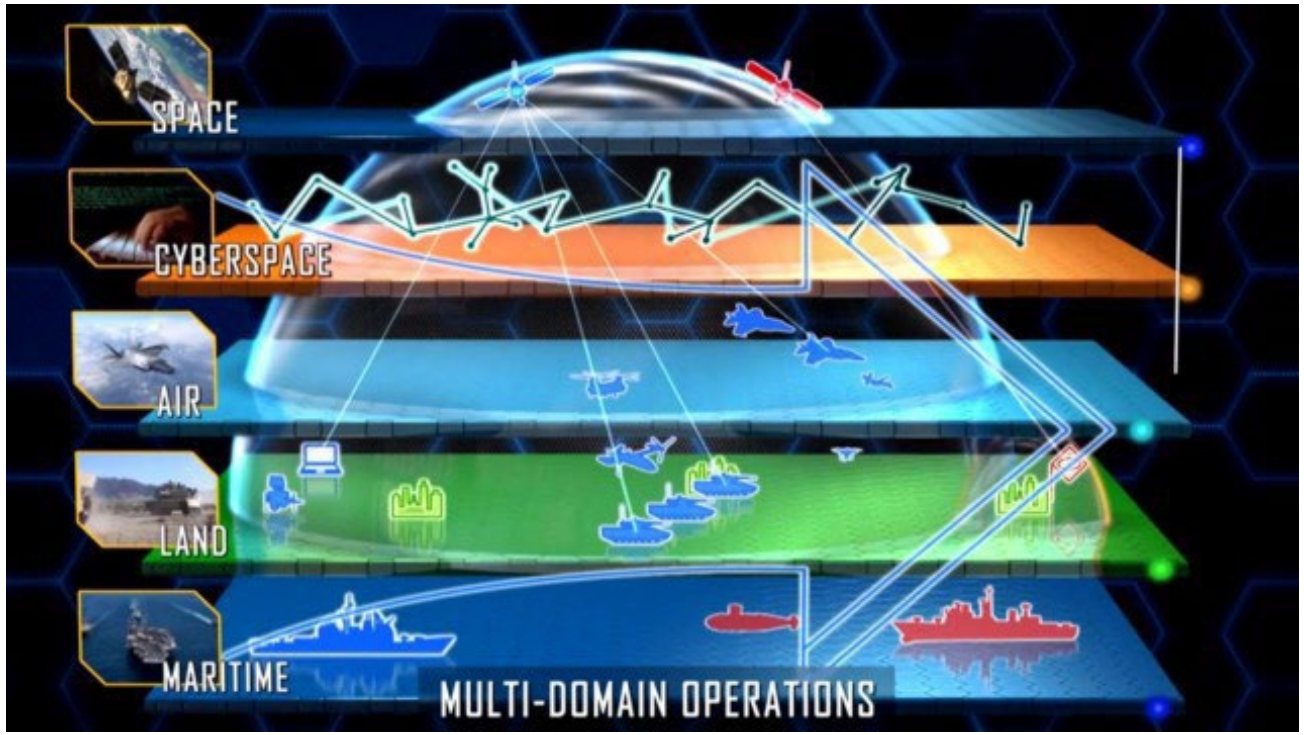
# INTRODUCTION


Photos courtesy of dvidshub.net and army.mil

# COMBAT OF THE FUTURE

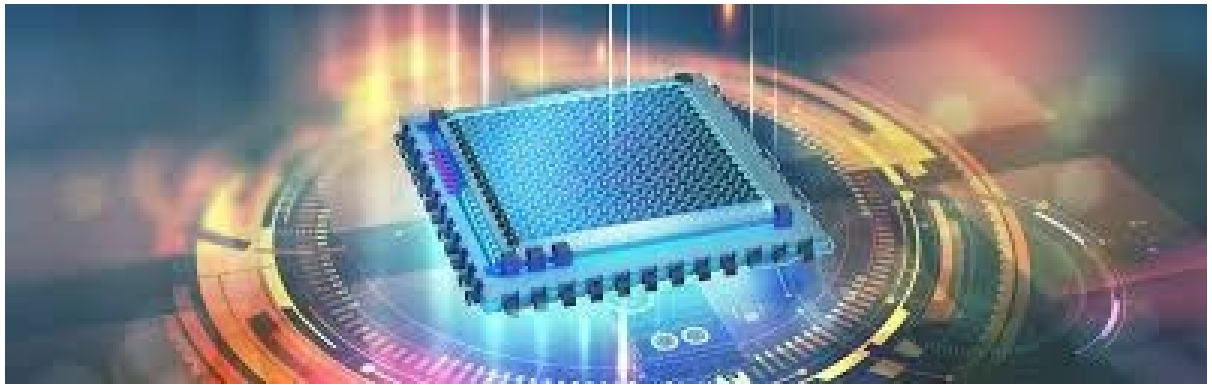
***What does the future look like…***

- **Large-scale, Multi-domain operations**
- **Distributed operations**
- **Transparent battlefield**




Photos courtesy of dvidshub.net and army.mil

# COMBAT OF THE FUTURE

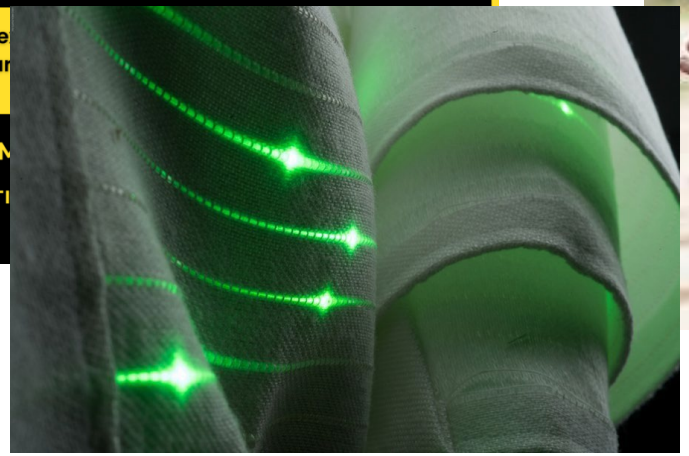
***What are the persistent problems…***

- **Overwhelming amount of data**
- **Processing speed to understand the battlefield**
- **Need to look farther, think faster & act smarter**

Photos courtesy of dvidshub.net and army.mil

# CURRENT ARMY INVESTMENTS



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# DEVCOM SOLDIER CENTER: OVERVIEW

**MISSION**: To provide the Army with innovative science and technology solutions to optimize the performance of our Soldiers**.**

**VISION:** Ensuring dominance through superior scientific and engineering expertise.

**MILITARY EMPLOYEES**
**48**

**GOVT. CIVILIAN EMPLOYEES**
**681**

**CONTRACTORS**
**258**

**TOTAL EMPLOYEES**
**987**

**745 Natick, 84 Orlando, 158 Playa Vista**

**University of Southern California Institute for Creative Technologies**
***A University Affiliated Research Center (UARC)***
Playa Vista, CA

**Natick Soldier Systems Center**
Natick, MA

**Central Florida Research Park**
Orlando, FL

# DEVCOM SOLDIER CENTER: SOLDIER PROTECTION

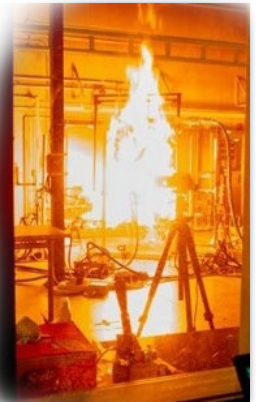
SOLDIER CENTRIC DESIGN

## Materials:

- Multifunctional Materials
  FR, EMI Shielding, Vector Protection, Thermal Mgt
- Protective Materials & Systems
  Ballistic, Chem-Bio, Signature Mgt
- Composite Materials
- Helmet Prototyping & Testing
- Ballistic Material Development, Testing & Integration

## Equipment:

- Combat Clothing & Individual Equipment
- Dress Clothing
- Chemical/Biological Protective Materials & Ensembles
- Load Carriage Systems
- Textile Prototyping & Testing
- Individual Hydration
- Cold Weather Clothing & Individual Equipment

# DEVCOM SOLDIER CENTER: SOLDIER SUSTAINMENT

DEVCOM SOLDIER CENTER

## SOLDIER CENTRIC DESIGN

### Combat Feeding

**Food Engineering and Nutrition:**
- Food preservation & stabilization
- Novel food processing technology
- Functional food prototyping

**Food Protection and Packaging:**
- Food contamination mitigation
- CBRN packaging solutions
- Microbiological testing of foods

**Food Service Logistics:**
- Innovative Military Ration Engineering & Food Processing Technologies
- Mechanical & Chemical Engineering for Refrigeration, Combustion and Sanitation

### Cargo and Personnel Delivery:

- GN&C technology for GPS denied/degraded environment
- Novel multi-use aerial dispersion systems
- Sensor development for safety devices
- Powered payload delivery system design

### Material Development

**Material Development and Optimization:**
- Support and guidance for Electromagnetic Interference (EMI) and X-ray Shielding
- Designs and build systems for unique customer applications
- Design for energy efficiency

**Additive Manufacturing:**
- Additive Manufacturing Design and Fabrication
- Complete Machining and Welding Facility
- Heavy Textile Design and Fabrication Facility

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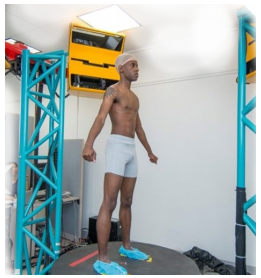
# DEVCOM SOLDIER CENTER: SOLDIER EFFECTIVENESS






SOLDIER CENTRIC DESIGN

## Training, Simulation and Learning Technologies

- Mixed and Augmented Reality Technologies for Training
- Synthetic Natural Environments
- Live Training Technologies
- Medical Training Technologies
- Artificial Intelligence and Machine Learning
- Adaptive Training
- Distributed Simulation
- Training Effectiveness
- Cyber Training Simulations
- Data at the Point of Impact
- Quantitative and Qualitative Analysis

## Physical/Cognitive/ Biological

- State Assessment
- Quantification of Close Combat Task Performance
- Predictive Performance Models
- Neuromodulation
- Exoskeleton
- Gut Microbiome
- Anthropometric Modeling
- Human Factors Product Test and Evaluation
- Soldier-Centeric Design
- Muscle & Immune Cell Model & Nutritional Intervention

## Soldier & Technology Integration:

- Sensors and situational awareness
- Leader Planning & Decision Tools
- Network and the “right” information

## Performance Enablers:

- Efficient Power & Energy Solutions
- Climate Conditioning For Extremes
- Robotics for Soldier and Squad

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# DEVCOM SOLDIER CENTER: WICKED PROGRAM SCHEMA

**Multidomain Concealment - *Invisible Soldier***
How does the Army enable the Soldier and small unit to delay and degrade detection by the enemy (human and non-human) across the electromagnetic (EM) spectrum, in order to disrupt the kill chain and maintain freedom of maneuver

**Unburden and Enable the Soldier/Squad - *Enabled Soldier***
How does the Army optimally equip and protect Soldiers as an integrated weapon system and the squad as an integrated combat platform

**Decision Dominance - *Enhanced Soldier***
How can the Army enhance the Soldier and small unit's situational understanding and optimize the decision-making process to achieve decision dominance

**Small Unit Logistics at the Edge - *Sustained Soldier***
How does the Army keep small units resupplied in a distributed and contested environment

# ARMY S&T INVESTMENTS





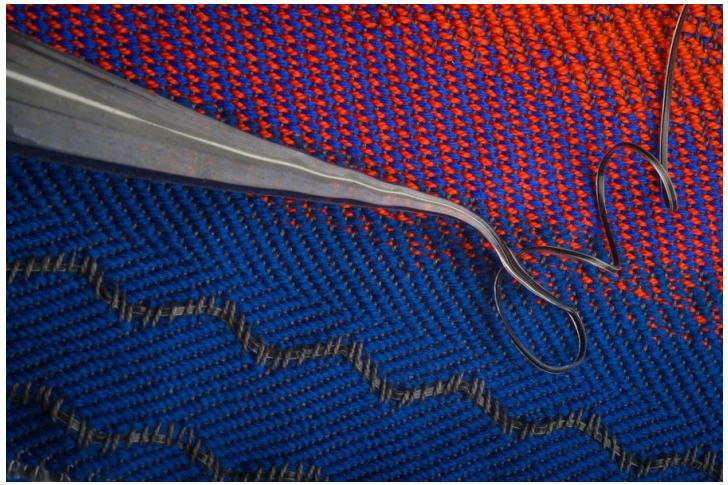








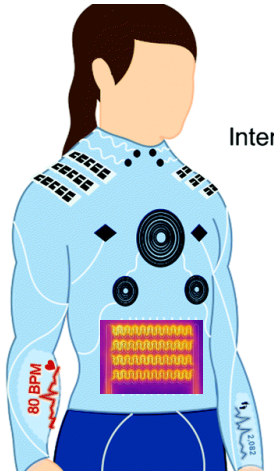
# E-TEXTILES FOR THE SOLDIER

- Army's integration of knitted conductive yarn as breadboard to transmit power and data from sensors to power source, making the textile an integration platform and reducing snag hazards for Soldiers

- Army partnered with MIT creating acoustic fabric that can "hear" converting audible sounds into electrical signals using piezoelectric materials

- MIT Army-funded research in programmable fiber that uses nano technology embedded into fibers to power sensors, store and analyze the data, and transmit to outside sources

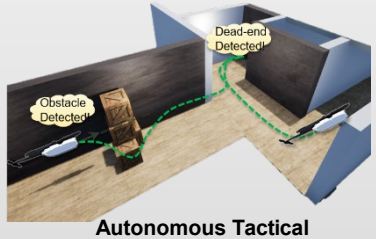



**E-textile:**
Interconnected large system
Washable
Stretchable
Flexible
Durable

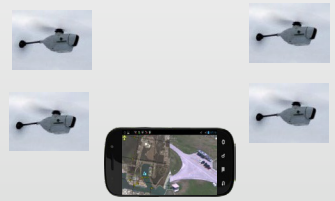
Photos courtesy of dvidshub.net and army.mil

# SOLDIER ROBOTICS & AUTONOMOUS SYSTEMS

- Develop, integrate, assess and demonstrate advanced levels of autonomy for squad level small UAS (SBS / SRR) to increase SA, Soldier Lethality and reduce cognitive burden during Close Combat operations
- Leverage and mature SUAS algorithms from ARL and others for Autonomous Navigation, Search, Perch and Stare, Human-Agent teaming, Targeting, and Collaborative Behaviors
- Demonstrate capabilities in operational representative environments during  frequent Soldier touchpoints
- Demonstrate capability on a government defined open architecture to support transition to PoRs and reduce program risk and cost
- Inform future Robotics and Autonomous Systems Requirements

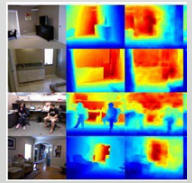



Autonomous Tactical Behaviors for Small UAS

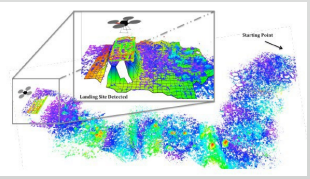


Multi-Agent Teaming of Army SUAS (SBS/SRR) & Soldiers

Demonstrate capability on modular, open architecture platforms



Multiscale depth estimation

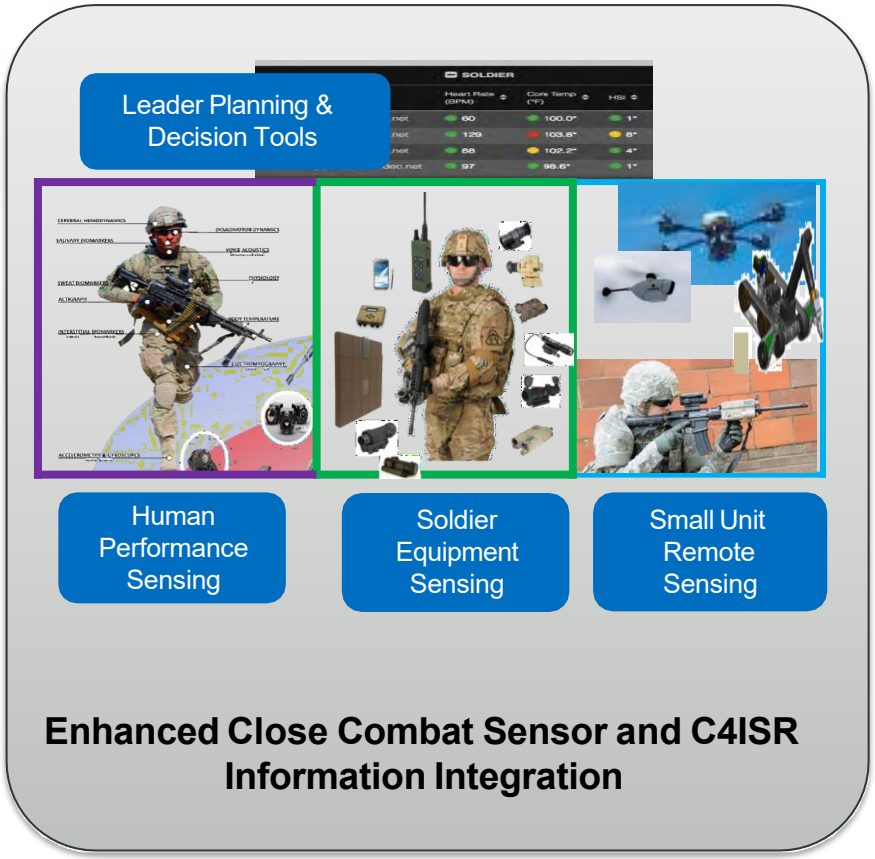


Landing site selection

**Squad / Platoon Level Small Unmanned Aerial System Autonomy & teaming to improve SA, Networked Lethality, and Survivability**

Enabling focus on the **fight** NOT flight

# SENSORED SOLDIER: MULTI-DOMAIN REMOTE SENSING




**Enhanced Close Combat Sensor and C4ISR Information Integration**

**Provide Soldier platform sensing across the formation and throughout the continuum of operations: planning, rehearsal, actions on the objective and After Action Review (AAR).**

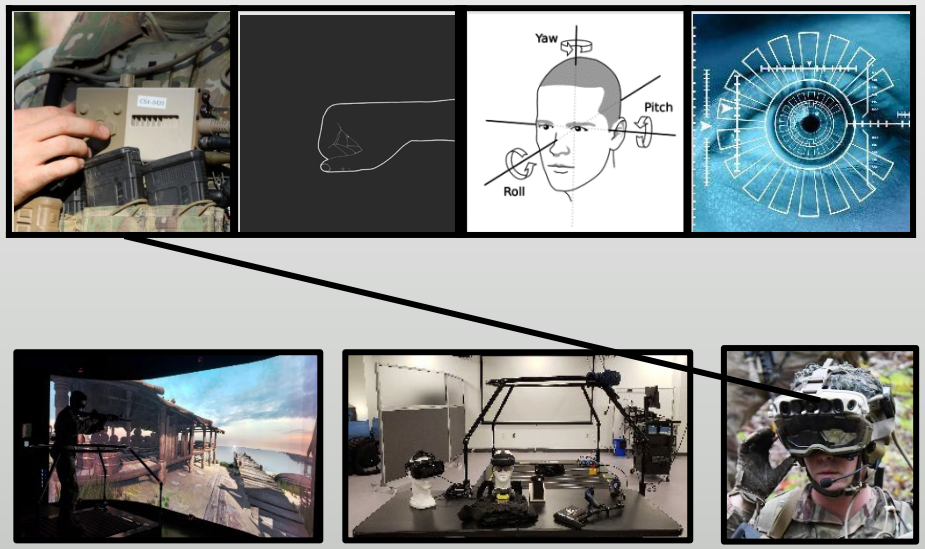
- **Leader Planning & Decision Tool** components transitioned to Programs of Record (PoR) that guide operational usage of physiological, equipment, and remote sensing hardware and information.
- **Human Performance Sensing and Integration** software components transitioned to PoRs that guide operational usage; Integration of MASTR-E and third party physiological and cognitive sensing across the Squad workflow.
- **Soldier Equipment Sensing and Integration** components transitioned to PM Close Combat Squad and other PoRs that guide operational usage and user experience of equipment status sensing across the Squad workflow.
- **Remote Sensing and Integration** software components transitioned to PoR that guides operational usage and user experience of remote squad sensing status across the Squad workflow.

# UX/UI: MULTIMODAL INPUT TECHNIQUES

- Multimodal human-machine interaction (HMI) techniques (e.g., gesture, gaze, voice, head movements) can enable fast, accurate, and user-friendly control of augmented reality (AR) head-worn displays (HWDs).
- Best implementation and combination of multimodal inputs to optimize human performance when interacting with AR during operations is currently unknown.
- Multimodal inputs can improve performance but have the potential to cognitively overburden the user if not optimally combined and/or paired with complementary tasks.

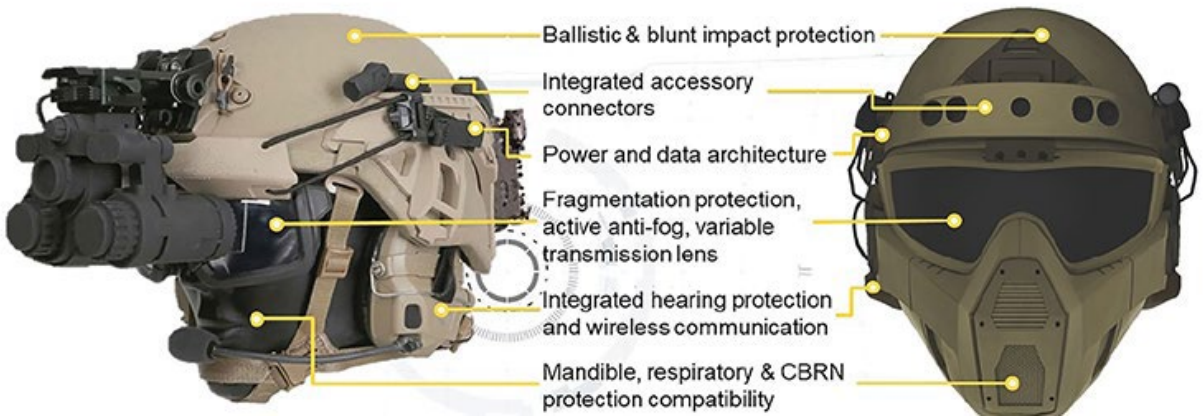
**Project Objectives:**

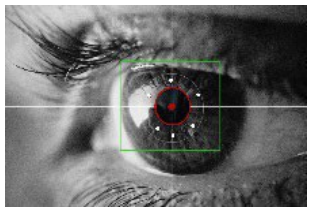
- Identify performance-optimized pairings of multimodal inputs to common AR tasks and input handoff best practices for enhanced tactical AR use.
- Incorporate augmented/virtual reality HWDs, physiology-based input technologies and algorithms (e.g., gesture-sensing wearables, eye and gaze depth tracking, voice recognition, IMU), and quantitative and qualitative human performance metrics to address these needs.

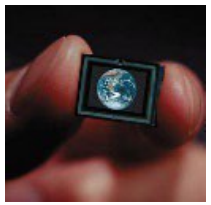



***Enable fast, accurate, and user-friendly multimodal control of augmented reality.***

# INTEGRATED SOLDIER SYSTEMS




- Integration of Soldier-worn sensor technologies and accessories
- Interface control document to standardize parts and attachment types
- Common on body interfaces, power distribution, and and data architecture for interoperabili

# HP MEASUREMENT & PREDICTION

**Increase Soldier & Squad Capability (Smarter (decide), Faster (move), more Lethal (threat elimination) & Precise (reduction of ambiguity)) through advanced training tools, optimization & enhancement strategies, and Soldier-system characterization & integration in order to increase lethality and resilience under close combat stress.**

**HP Analytics for Decision Dominance**

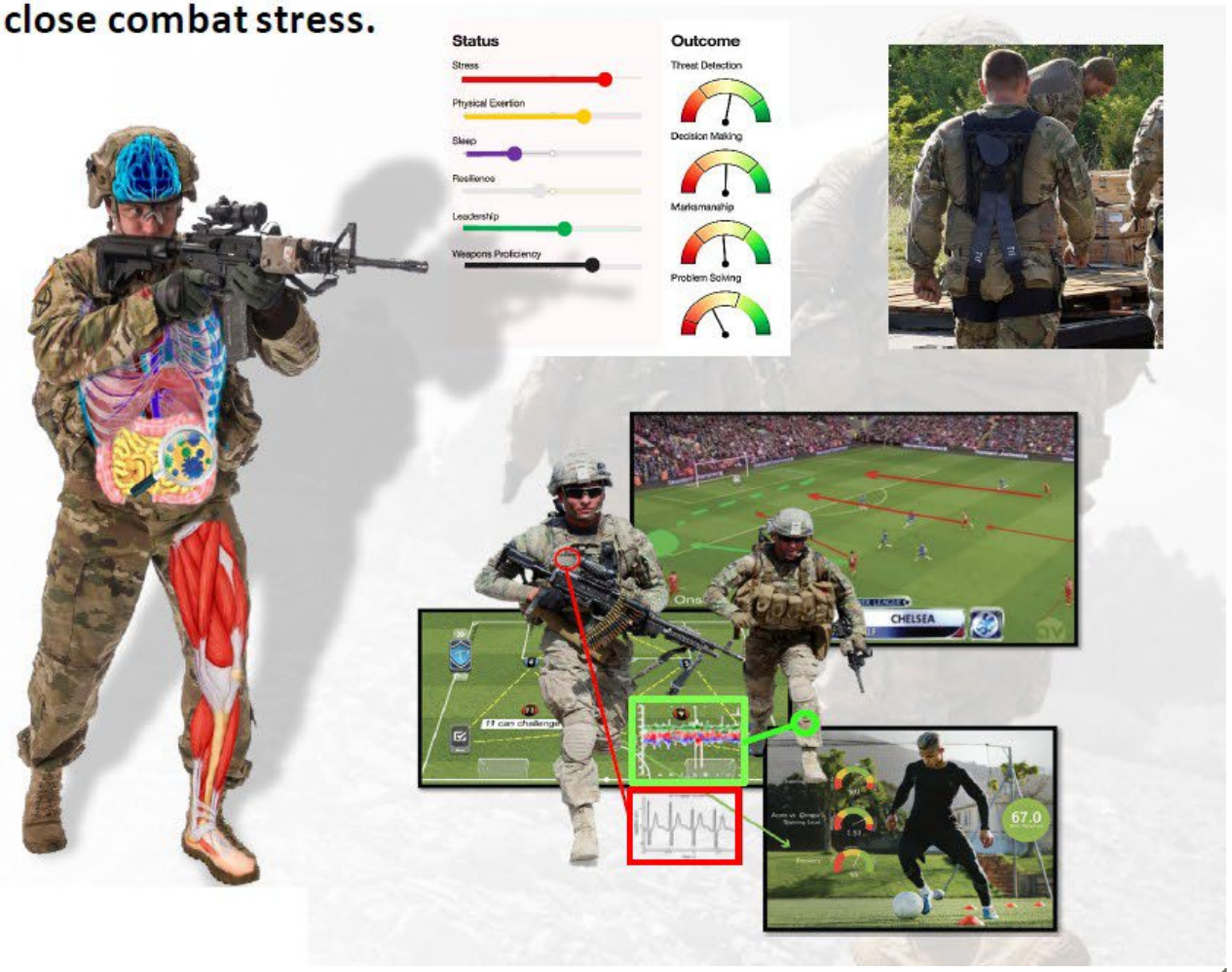
Development of advanced human performance analytics and platforms to quantify Soldier and Small Unit performance and readiness for targeted interventions and decision dominance

**Trade Space Parameters for Soldier & Squad Lethality**

Inform acquisition decisions thru development of methods, metrics, and M&S to quantify the impacts of Soldier equipment and technology on the lethality trade space for both the Soldier and Small Unit.

**Enhancement for Soldier & Squad Overmatch**

Optimize and enhance Soldier/Squad cognitive/physical capacity and resiliency to adverse conditions. Aim to achieve decreased lost duty time, increased readiness, increased recovery and optimize/enhance tactical performance.



# LEVERAGING COTS WEARABLES

**Framing Question: can wearables provide commanders with warfighter readiness and performance information to enhance multi-domain operational decision making?**

## Inform Decision Making

Learn what decisions could be made at each echelon & domain

## Minimize Warfighter Burden

Identify tools to automate and supplements warfighter/leadership readiness status and reporting tasks


## Move Data Regionally

Demonstrate data movement across vast distances (1,000's mi)

## Integrate DoD Stakeholders

Integrate wearables capabilities from across the DoD



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# LEVERAGING COTS WEARABLES

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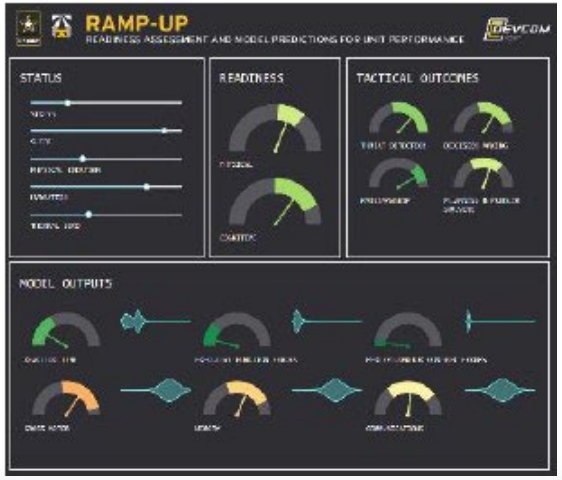
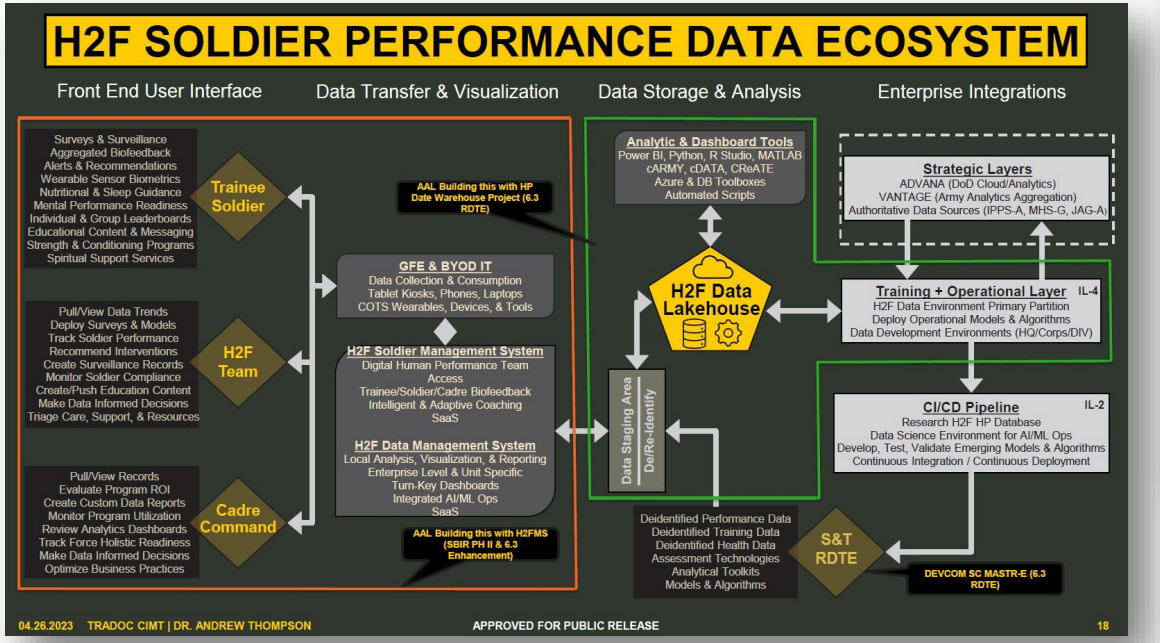
**Stakeholders**

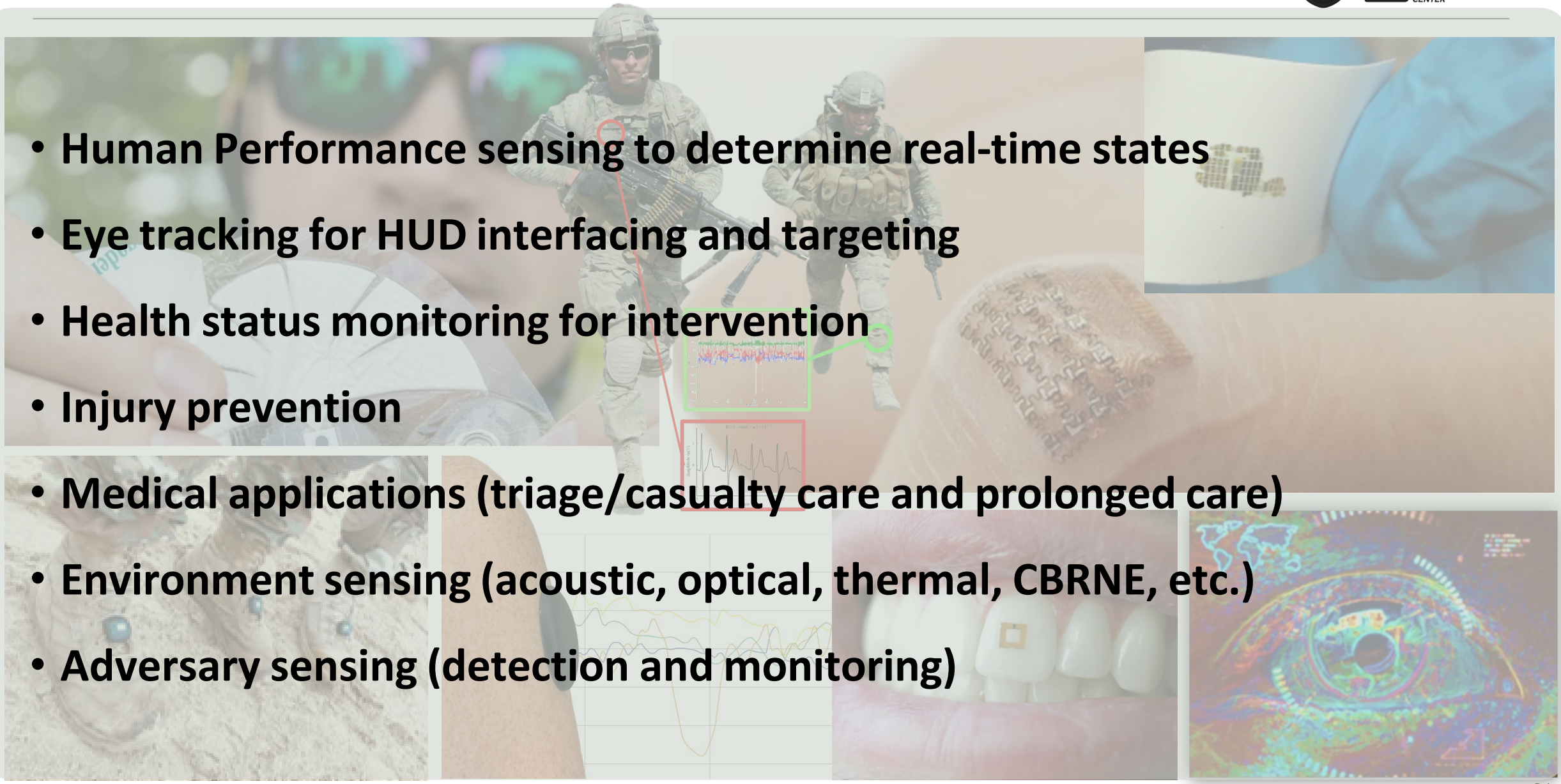
capabilities

# LEVERAGING COTS WEARABLES

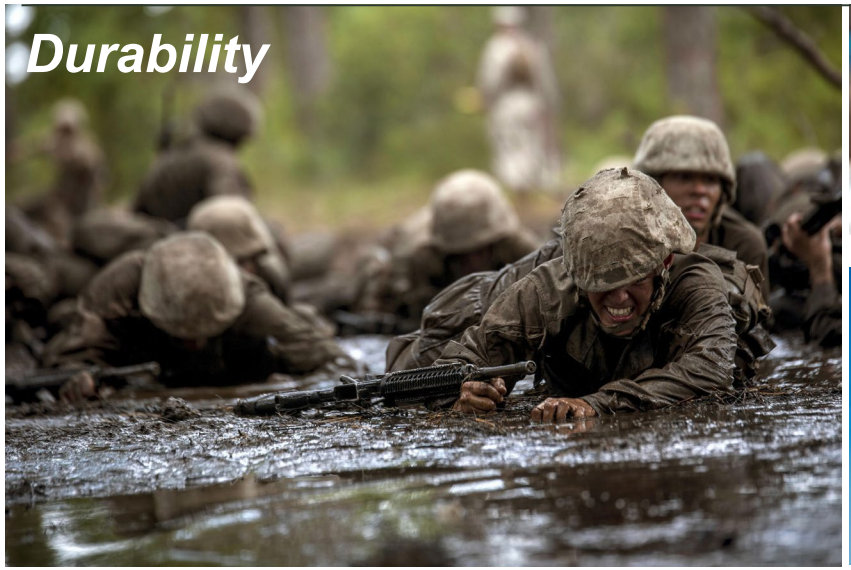

# FUTURE APPLICATIONS & OPPORTUNITIES



- Human Performance sensing to determine real-time states
- Eye tracking for HUD interfacing and targeting
- Health status monitoring for intervention
- Injury prevention
- Medical applications (triage/casualty care and prolonged care)
- Environment sensing (acoustic, optical, thermal, CBRNE, etc.)
- Adversary sensing (detection and monitoring)

Photos courtesy of dvidshub.net and army.mil

# CHALLENGES









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# THANK YOU.


PROTECTED • OPTIMIZED • LETHAL


U.S. ARMY