Decision Superiority Optimization

Artificial Intelligence, Machine Learning and Cognitive Agility

SimCentric Technologies

New protective military suit

The U.S. Special Operations Command is asking designers for ideas to produce a suit to protect soldiers of the future. The suit will have advanced armor, a built-in power supply and a see-through display that will show live data feeds in the helmet.

Government requirements for the suit

- **Displays** Give wearer feedback information relevant to the environment from an array of sensors

Screenshot from Army video

- **Health status** Embedded systems monitor the body's vital statistics such as oxygen levels and body heat
- **Lightweight design** Minimizes load and maximizes protection

- **Armor** Protects the head and body, especially from explosions, by using advanced materials
- **Power** Built-in management systems along with wearable computers, antennas and a programmable radio
- **Mobility** Exoskeleton will be powered to enhance endurance and agility

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Source: U.S. Special Operations Command, Chicago Tribune

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Defining "The Problem"

Intelligence Collation / Analysis

- Exponential global data generation:
  - 1992: 100GB per day
  - 2002: 100GB per second
  - 2013: 28,875GB per second
- Camouflage for various asymmetric threats
- Military operations are inherently intelligence led and time sensitive
- How to quickly find the relevant knowledge needle in the information haystack?

Military Operator Assimilation

- Humans have inherent bottlenecks absorbing simultaneous information – both attentional and content based
- Typically more than three information sources leads to cognitive overload
- Must balance immediate tactical inputs with top-down / lateral information
- Monitor operator cognitive effectiveness through multiple biomarkers
- Moderate information type, quantity and format based on capacity to absorb

The "Push" - VSALT

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Visual Search and Linkage Tool

Humans:
Excel at Intuitive Linkages but…
Rapidly overwhelmed by data qty

Computers:
Rapid processing of big data, but…
Poor at applying intuition

VSALT:

- Particle based system for big data search representation
- Artificial Intelligence & Machine Learning supporting:
  - Automated Analysis
  - Multi-Filtration Levels
  - Artificial Neural Pathways
  - Game Theory
- Drag relative importance for updates in real time
- Refine / change parameters for real time updating
- Database agnostic
- Currently at TRL 3 – CDE UK

Endstate: Rapidly process vast quantities of information into finite, relevant knowledge

The “Pull” – Cognitive Monitoring

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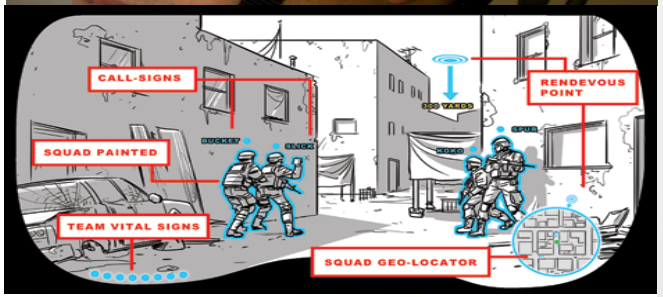
Persistent Biomarker Monitoring for scalable Intel Provision

- Excessive information stimuli causes cognitive overload = combat ineffective
- Military Operator must only receive succinct knowledge pertinent to that mission
- Time, quantity, format & device type are adjustable
- Use of various biomarkers and wearable tech to monitor operator cognitive state
- Implement Machine Learning to tailor data flow to individual operator biomarkers
- Current partnered study with University of Newcastle
- Branch studies:
  - Validate new technologies (e.g. AR)
  - Build individual neuroplasticity



Endstate: Relevant, succinct and scalable data supports the Operator.

Use Case 1 – Infiltration to Target

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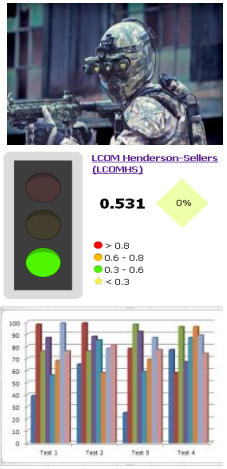
Machine Learning Refinement

Multi-Database Collation

- UAV ISR Feeds
- HUMINT
- SIGINT
- Enemy Locations
- Civilian Locations
- Terrain / City Profile
- Recommended Routes
- Predictive Ballistic Modelling
- Friendly Force Locations
- Metadata (Location, Time, etc)
- Social Media Feeds

Cognitive Upload



Data Filtering

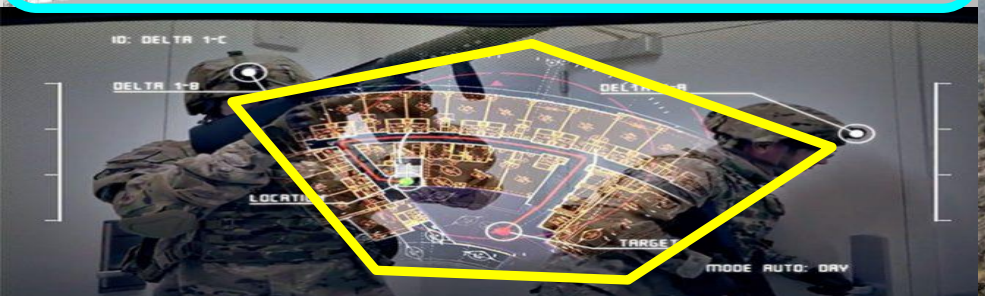
AI Algorithm

- Log Operator Cognitive State
- Prioritize Intelligence
- Deliver COP to Operators
- Enable manual adjustment
- Persistent and Continuous

Operator

Intel Receipt

- UAV ISR Feeds
- Terrain Profile
- Recommended Routes
- Historical Analysis
- Metadata



Use Case 2 – Troops in Contact

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Machine Learning Refinement

VSALT

Multi-Database Collation

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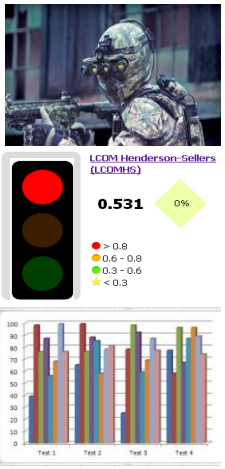
- Terrain / City Profile
- Recommended Routes
- Predictive Ballistic Modelling
- Friendly Force Locations
- Metadata (Location, Time, etc)

Cognitive Upload



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Mission Profile Ubiquity

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Mission Relevant for…

- Civil Affairs
- Counterinsurgency
- Counterterrorism
- Countering Weapons of Mass Destruction
- Direct Action
- Foreign Humanitarian Assistance
- Foreign Internal Defense
- Hostage Rescue / Recovery
- Military Information Support Operations
- Security Force Assistance
- Special Reconnaissance
- Unconventional Warfare
- Preparation of the Environment
- Aerial Combat and Attack Aviation

Future Technology Integration?

- Adversary Biometric Analysis
- Facial & Voice Recognition
- Autonomous System Vectoring
- Augmented Reality (AR) Hardware
- Android Tactical Assault Kit (ATAK)
- TALOS Incorporation
- Electro-Magnetic Spectrum (Cyber, EW)
- Network Centric Warfare
- Cyclical Data Analysis
  - Weapon Signature Detection
  - Chemical Biomarkers
  - Medical Condition Triggers
  - Ammunition State Monitoring
  - Terrain Threat Assessment (AI)

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Questions?