WARFIGHTER READINESS RESEARCH 
OVERVIEW

Mr Mark Sturgell
711 HPW/XPT

Human Effectiveness Directorate
711th Human Performance Wing
Air Force Research Laboratory
Air Force Materiel Command
Overview

- Mission
- Organization
- Collaborators
- Research
- BRAC
- On The Horizon
711 HPW/RHA Workforce Demographics

Mesa
104 Gov’t / 120 Ktr

Gov’t Employees Legend
(#assigned/# auth) as of Feb 09
FY09 Funding

S&T Base Funding
$21.3M

Total Funding Leveraged
$58.6M
(Projected)

As of: Feb 2009
Government Collaborators

AF Agency Collaboration

Other Agency Collaboration

International Collaboration
Growing Extramural Collaborators and Linkages
Vision & Mission Statements

AFMC Vision
War-winning capabilities on time, on cost

AFMC Mission
Deliver war-winning Technology Acquisition Test Sustainment expeditionary capabilities to the warfighter.

AFRL Vision
We defend America by unleashing the power of innovative science and technology.

AFRL Mission
Leading the discovery, development, and integration of affordable warfighting technologies for our air and space force.

711 HPW/RH Vision
Decision Dominance
Anticipate-Influence-Affect-Survive.

711 HPW/RH Mission
Lead revolutionary S&T for superior airman cognition, readiness, performance, and survival
• Decision Making
• Forecasting
• Performance
• Training
Research, demonstrate and transition human performance methods and technology to enable the right people to have the right skills, knowledge, experience and capabilities at the right time to make the right decisions.

Dominate the Decision Environment
Why Are We Here?
S&T Challenges

- Develop experiential decision environments that... provide effective, on-demand learning, training, rehearsal and decision dominance
- Operational readiness through ...realistic immersive training environments
- Options for individual, collective, and joint training
  - base training decisions on training effectiveness evaluations
  - maximize use of new learning techniques, simulation technology, embedded training
  - anytime, anyplace training, rehearsal and decision dominance
  - maintain skill proficiencies, and reduce individual and collective training costs, time and resources
Mission Effective Performance
Core Technology Areas of Research

**Immersive Environments**

- Live, Virtual and Constructive Modeling and Simulation

**Continuous Learning**

- LVC Training and Aiding Methods

**Immersive Technologies**

**Performance Measurement and Tracking**

**Cognitive Modeling**

**Computational Replicates**
Optimize readiness training and rehearsal experiences by providing scientifically-based advanced distributed simulation capability incorporating *live, virtual, and constructive* players.
Core Processes

Achieve S&T Vision
DMO to Decision Environments
FLTC 1 Anticipatory C2I
FLTC 8 Affordable Mission Generation and Sustainment

Transition to Acquisition Programs
WRAPMTS ATD
20/20 ATD
JTAC-VT HVP
TSPG Membership

Rapid Response and Tech Support
UAS Performance-based training
M2ESA Lights
Support to AFSO21
Mission Effective Performance Relocation in 2011

2009

• Move Mission Effective Performance laboratories
  – 45,000 square feet of lab space
  – Flexible design

• Consolidate division scientists and engineers in single building

• Integrate with other on-base laboratories

2011
Wing Scheduled Phased Moves

- Apr 2010 - 711 HPW/RHP, 711 HPW/RHX
- Jun 2010 - 711 HPW/RHA, USAFSAM/ET and OE
- Sep 2010 – USAFSAM/ED
- Oct 2010 – USAFSAM/PH
- Jan 2011 – USAFSAM/FE
- May 2011 – 711 HPW/HP

(15 Sep 2011 - BRAC Implementation Deadline)
Recent S&T Contributions to Ops

- Proficiency Based Ready Aircrew Training Program (P-RAP) – ACC-requested field studies to implement performance assessment and to validate mixes of live and virtual training for ops

- F-35 Visualization and Evaluation - Support ACC/A8 to develop alternative solution for HMD integration into F-35 FMS

- NASA OBVA - Support USAF/SAM in development of eye-limited simulation laboratory to enable validation of pilot vision standards

- Thumbprint Surveys - CSAF tasker – Worldwide data collection from ops to better define mixes of live and virtual training

- Unmanned Aerial Systems - CSAF tasker - Improve quality and assessment of UAS training and operations

- Standard Space Trainer (SST) - AFSPC-sponsored common adaptive learning and simulation capabilities for multiple space systems

- Navy Maritime Operations Center (MOC) – CNO-requested mission essential competency support to define training requirements and gaps
## Science & Technology For Training and Logistics Transformation

### SCHEDULE:
- BAA Announcement: Dec 2004 (BAA 05-04 HE)
- Receive Proposals: Open through 31 Dec 2009
- Number of Awards: TBD

<table>
<thead>
<tr>
<th>Contract Type:</th>
<th>Cost Plus Fixed Fee or Cost (no fee)/ Cooperative Agreements or Grants</th>
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<tbody>
<tr>
<td>Ceiling ($M):</td>
<td>$34.9</td>
</tr>
<tr>
<td>Acquisition POC:</td>
<td>Jay Carroll (711HPW/RHA)</td>
</tr>
<tr>
<td></td>
<td>480-988-6561 x148</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:jay.carroll@mesa.afmc.af.mil">jay.carroll@mesa.afmc.af.mil</a></td>
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</tbody>
</table>

### Description
Research, develop, demonstrate, evaluate, and transition leading edge technologies and methods to train warfighters and optimize human-centered logistics processes, enabling the expeditionary aerospace force.

### Benefits to the Warfighter
- Immersive, theater level, integrated training and rehearsal systems
- Mission rehearsal based on rapid integration of tactical information
- Theater-level performance measurement & assessment
- Reduced cost and overhead associated with DMO training & rehearsal
- Reduced footprint and more efficient reachback
- More efficient logistics operations
  - Faster planning/replanning
  - Less manpower & quicker deployment response

### Technologies
- Models of human learning and effectiveness
- DMO performance measurement & assessment
- C4ISR live/simulation linkage and recovery
- Distributed event integration & management
- Integrated Portable Human Computer Interfaces
Warfighter Readiness Training Research Contract

**Contract Type:** CPFF, IDIQ, Multiple Delivery Orders  
**Period of Performance:** July 2005 – Jan 2012  
**Ceiling:** $300M  
**Place of Performance:** Mesa, Arizona ([www.mesa.afmc.af.mil](http://www.mesa.afmc.af.mil))  
WPAFB, OH ([www.wpafb.af.mil](http://www.wpafb.af.mil)) – after Summer 2010

**POC:** Jay Carroll (711HPW/RHA)  
480-988-6561 x148  
jay.carroll@mesa.afmc.af.mil

<table>
<thead>
<tr>
<th>Description</th>
<th>Benefits to the Warfighter</th>
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</thead>
</table>
| On-demand integration of live, virtual, and constructive systems to immerse the warfighter in realistic operational environments | • Immersive, theater level, integrated training and rehearsal systems  
• Mission rehearsal based on rapid integration of tactical information  
• Theater-level performance measurement & assessment  
• Enhanced training realism  
• Reduced cost and overhead associated with DMO training & rehearsal  
• Reduced footprint and more efficient reachback |

**Technologies**

- Rapid database and scenario development  
- Models of human learning and effectiveness  
- DMO performance measurement & assessment  
- C4ISR live/simulation linkage and recovery  
- Distributed event integration & management  
- Distributed system reliability & security
# Joint Terminal Attack Control Training and Rehearsal System

**Description**

- Research effort to close technology gaps in Close Air Support (CAS) / Special Tactics training and rehearsal capabilities

**Technology**

- Study impact of immersive CAS simulation
- High fidelity, realistic visualization with sensor, simulator and database correlation
- Enhance CGF enabling technologies for CAS
- Fully functional emulated JTAC C2 Kit devices
- Research and assess HMD CAS applications

**Benefits to the Warfighter**

- Simulation and visualization for Joint Terminal Attack Control and Special Tactics
- Unique tool for evaluating MR status of operators, tactics feasibility and CONOPS
- Reduced operational risk due to OJT
- Provide After Action Review (AAR) feedback; reduce learning curve; augment live fly AC
- Just-in-time proficiency training and rehearsal development capability
- Realistic, on-call, training and rehearsal with JTAC C2 Tool Kit equipment

## Technology Investment Schedule (FY)

<table>
<thead>
<tr>
<th>Year</th>
<th>Technology Investment</th>
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</thead>
<tbody>
<tr>
<td>2005</td>
<td>Develop Immersive CAS Environment</td>
</tr>
<tr>
<td>2006</td>
<td>Schoolhouse Training Environment</td>
</tr>
<tr>
<td>2007</td>
<td>Emulated JTAC C2/BAO Kit</td>
</tr>
<tr>
<td>2008</td>
<td>IOS and Develop PETS</td>
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<tr>
<td>2009</td>
<td>Garrison/Deployable Trainer</td>
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<tr>
<td></td>
<td>Man-Portable Tech. Assessment</td>
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<tr>
<td></td>
<td>Technology Availability</td>
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</tbody>
</table>

- **TRL=5**
- **TRL=6**

**Technology Availability**

- 711HPW/RHAE
- Computer Generated Forces (CGF); Head Mounted Display (HMD); Aircraft (AC)
- Mission Ready (MR); On-the-Job Training (OJT); Close Air Support (CAS)
Deployable Distributed Mission Operations (DMO)

711 HPW/RHA

Technology Investment Schedule (FY)

<table>
<thead>
<tr>
<th>Spiral 1: Desktop testbed and syllabus dev</th>
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</thead>
<tbody>
<tr>
<td>- Prelim fidelity reqs</td>
</tr>
<tr>
<td>- Multi-mission scenarios and tools</td>
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<tr>
<td>Spiral 2: Learner models, meas</td>
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<tr>
<td>- Training/AAR mgt tools</td>
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<tr>
<td>Spiral 3: Reconfig mission task demo</td>
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<tr>
<td>- Day/Night database and visuals</td>
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<tr>
<td>Spiral 4: Deployed DMO Demo</td>
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<tr>
<td>- Effectiveness assessment</td>
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<tr>
<td>- Final fidelity reqs</td>
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</tbody>
</table>

Tech Availability

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>• Mission and fidelity reconfigurable integrated suite for distributed tactical training, rehearsal, and exercise</td>
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</table>

Benefits to the Warfighter

<table>
<thead>
<tr>
<th>Benefits to the Warfighter</th>
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</thead>
<tbody>
<tr>
<td>• Deployable and reconfigurable simulation environment with DMO reachback capability</td>
</tr>
<tr>
<td>• Flexible, individualized training environment</td>
</tr>
<tr>
<td>• Enhanced management and learning focus of rehearsal and exercise events</td>
</tr>
<tr>
<td>• Performance-based, tactically relevant training and rehearsal fidelity trade-offs</td>
</tr>
<tr>
<td>• Leverages compact immersive visual environment CE technologies</td>
</tr>
<tr>
<td>• Quantified fidelity levels for mission training and rehearsal for operational units</td>
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</tbody>
</table>

Technologies

<table>
<thead>
<tr>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mission-task level fidelity requirements</td>
</tr>
<tr>
<td>• Reconfigurable architecture to support diverse DMO training and rehearsal events</td>
</tr>
<tr>
<td>• Agent-enabled syllabus authoring methods</td>
</tr>
<tr>
<td>• Simulation/instruction management tools</td>
</tr>
<tr>
<td>• Interactive after-action-review/debrief tools</td>
</tr>
</tbody>
</table>
Networked LVC
Electronic Warfare Training

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LVC EW Training Operational Concept

Technology Investment Schedule (FY)

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
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<tbody>
<tr>
<td>07</td>
<td>EW Range trng analysis</td>
</tr>
<tr>
<td>08</td>
<td>Preliminary system design</td>
</tr>
<tr>
<td>09</td>
<td>Prototype LVC Bridge</td>
</tr>
<tr>
<td>10</td>
<td>Model modern ftr EW suite</td>
</tr>
<tr>
<td>11</td>
<td>Build on-range live fly demo 1</td>
</tr>
<tr>
<td>12</td>
<td>Model modern ISR EW suite</td>
</tr>
<tr>
<td></td>
<td>Documentation and Final Report</td>
</tr>
</tbody>
</table>

Benefits to the War Fighter

- Denser, more realistic EW threats for advanced platform and ISR training
- Increase utility of legacy range emitters
- Integrate “low cost” part-task emitters
- Provide robust IADS for LVC ranges using validated DMO technologies
- Automated Range Training Officer
- Range MLS capability

Description

- LVC Technologies for interactive team EW training against validated, robust, modern threats … any time, in any airspace

Technology

- High refresh rate, network supported LVC
- Implement predictive algorithms for live feeds to high refresh rate simulations
- Measure training effects on live range

Benefits to the War Fighter

- Life-Saving Training
- Documentation and Final Report

Technology Investment

EW Range trng analysis
Preliminary system design
Prototype LVC Bridge
Model modern ftr EW suite
Build on-range live fly demo 1
Model modern ISR EW suite
Build multi-ship/onboard demo 2
Documentation and Final Report
Tech Availability

Technology

- High fidelity missile fly-outs
- Virtual engagement via datalink/ACMI
- Aircraft datalinks (Link 16 / SADL)
- FAA feeds
- ACMI
- TENA/ACMI Gateway
- DIS
- Supporting constructive sims (XCITE)
- LVC Network Bridge: Live to constructive
- DIS
- Other LVC Players

LVC EW Training Operational Concept

Description

Benefits to the War Fighter

Technology

- High refresh rate, network supported LVC
- Implement predictive algorithms for live feeds to high refresh rate simulations
- Measure training effects on live range
Where We Are Going?

Automated Systems Tailor Scenarios Based Upon Individual Proficiency

Embedded Intelligent Tutors Coach Students

Embedded Agents Assess Performance

AEF Spin-Up and Reconstitution

Typical Total Force AEF:
1 - 2 ISR Squadrons
3 - 4 Austere locations & AFSCC base

AEF 1 & 2
Spin Up
Normal Ops & Training
Spin Up
AEF 3 & 4
Spin Up
Normal Ops & Training
Spin Up
AEF 5 & 6
Spin Up
AEF 7 & 8
Spin Up
AEF 9 & 10

~25,000 personnel
2 - 3 Combat Wings (Fighters / Bombers)
2 1/2 Mobility Wings (Tankers / Airlift)

20 months
4 months
14 months
2 months
Learning Management Tech for Distributed Mission Operations
(Planned New Start)

711 HPW/RH

Technology Investment Schedule (FY)

<table>
<thead>
<tr>
<th>Spiral 1: Authoring tools</th>
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<tbody>
<tr>
<td>- Assessment methods</td>
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<tr>
<td>- Prelim planning tools</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Spiral 2: Training mgmt tools</th>
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<tbody>
<tr>
<td>- Learner tracking and mgmt tools</td>
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</table>

<table>
<thead>
<tr>
<th>Spiral 3: Distributed perf tracking</th>
</tr>
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<tbody>
<tr>
<td>Next Gen Instruct/op station</td>
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</table>

<table>
<thead>
<tr>
<th>Spiral 4: Integ mgmt/DMO Dev/Del/Eval Demos</th>
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<tbody>
<tr>
<td>- DMO learning/federation guidelines</td>
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</table>

Tech Availability

Benefits to the Warfighter

- Instructionally-rich local and distributed training and rehearsal
- Individualized training environment
- First-order management and learning enhancements to rehearsal and exercise events
- Performance-based training and rehearsal design, delivery and evaluation
- Continuous training and rehearsal tracking and proficiency enhancement

Description

- An interactive toolset incorporating event planning, instructional design and scenario authoring capabilities along with performance measurement methods for DMO

Technologies

- Event and mission planning tools
- Coach-enabled scenario authoring
- Interactive syllabus development methods
- Automated instructional delivery and management
- Interactive after-action review/debrief tools
Demonstrate the technology to rapidly develop and validate multiple computational replicates (COREs) to serve as synthetic teammates in a C2I training and rehearsal environment.

**Technology**

- Automated encoding of knowledge bases
- Semi-automated infrastructure for CORE development and validation

**Benefits to the Warfighter**

- 90% reduction in time and cost to develop psychologically valid computational cognitive process models for training applications in complex, relevant environments
- Greater availability of flexible, realistic training with constructive entities

**Description**

Demonstrate the technology to rapidly develop and validate multiple computational replicates (COREs) to serve as synthetic teammates in a C2I training and rehearsal environment.

**Technology Investment Schedule (FY)**

- Data ID & Standardization
- Tech Documentation
- CORE Demonstration

**Tech Availability**

13 14 15 16 17
# Shareable Authoring, Assessment, Adaptation for Decision Making Teams in LVC Ops

**Proposed New Start**

## Description
Develop shareable scenario authoring, knowledge management and assessment, and dynamic adaptation methods and data for large teams in LVC decision environments.

## Technology
- Common content authoring SCORM, HLA, DIS, TENA
- Content tagging and mgt across architectures
- ICD for scenario authoring and sharing
- Common metrics authoring, indexing, warehousing
- Design interface spec for content mgt and delivery
- Exemplar integrated and adaptive methods

## Technology Investment Schedule (FY)

<table>
<thead>
<tr>
<th>Prior</th>
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<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
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</thead>
<tbody>
<tr>
<td>Define shareable content reqs</td>
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<tr>
<td>Common content authoring</td>
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<td>Common deliver authoring</td>
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<tr>
<td>Common know/skill assessment meths</td>
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<tr>
<td>Common trng/aide management meths</td>
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<tr>
<td>Integrated adaptive content for LVC ops</td>
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</table>

## Benefits to the Warfighter
- Common content and requirements across multiple LVC architectures/environments
- Common design, assess, manage, and report content/outcomes for team of team events
- Reusable/derisked training, rehearsal, aiding strategies, scenarios, and metrics for global LVC ops
- Validated scenarios, and metrics across architectures
- Continuum of training and ops exemplar
- LVC content reference modules
### Gaming for Training in Complex Domains

(Proposed New Start)

#### 711HPW/RHA

#### Technology Investment Schedule (FY)

<table>
<thead>
<tr>
<th>Description</th>
<th>Benefits to the Warfighter</th>
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<tbody>
<tr>
<td>• Develop, demonstrate, and evaluate utility of game-based methods for individual and team training in complex decision making domains. Identify gaming features that promote learning</td>
<td>• Taxonomy and guidelines for adapting game technology for training applications</td>
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<tr>
<td></td>
<td>• Leverages game developer investment guided to valid instructional strategies requirements</td>
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<tr>
<td></td>
<td>• Game-based approaches as supplements to live, virtual, and constructive operations</td>
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<td></td>
<td>• Training environments with the engaging qualities of a game and the instructional rigor of an intelligent tutoring system</td>
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<th>Prior</th>
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<th>14</th>
<th>15</th>
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<tbody>
<tr>
<td>Identify serious games</td>
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<tr>
<td>Taxonomy development</td>
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<td>Vignette authoring</td>
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<td>Performance assessments</td>
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<td>Training strategies</td>
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<td>Integration/application</td>
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<tr>
<td>Utility assessment</td>
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<td>Tech Availability</td>
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<tr>
<td>Scenario development</td>
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<tr>
<td>Performance assessment/tracking</td>
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<tr>
<td>Data archiving and retrieval</td>
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<td>Intelligent tutoring/coaching</td>
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<td>Links into more robust military environments</td>
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Questions?