



# Assessing Distributed Team Performance in DARWARS Training: Challenges and Methods

Lawrence A. Aiello, Ph.D., Director of the Center for Distributed Team Research

William O. Rouse, Ph.D., Director of the Center for Human-Computer Interaction

Aptima<sup>®</sup>, Inc.  
Cambridge, MA

2004  
Cambridge, MA

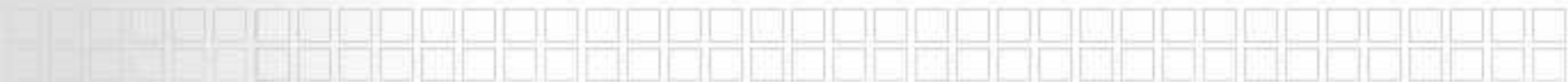
# ACKNOWLEDGEMENTS

---

This work was supported by DARPA, under the direction of Ralph Chatham, via ONR contract N00014-03-C-0279.

The views and conclusions contained in this document are those of the authors and should not be interpreted as presenting the official policies or position, either expressed or implied, of the Department of Defense or the U.S. Government unless so designated by other authorized documents.

We thank Bruce Roberts, Gail Mitchell, Jason Robar, Jason Sidman, Tad Brunye, and Elliot Entin for assistance in the work reported here.

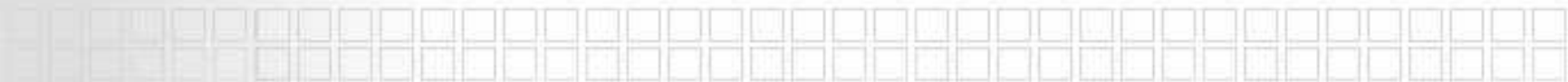


# DARWARS

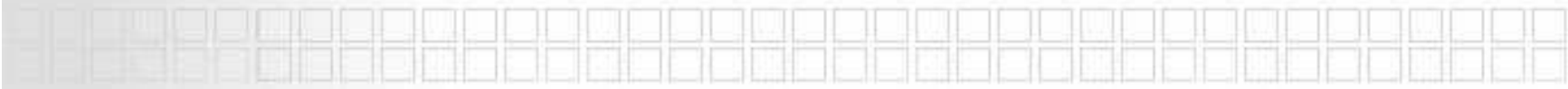
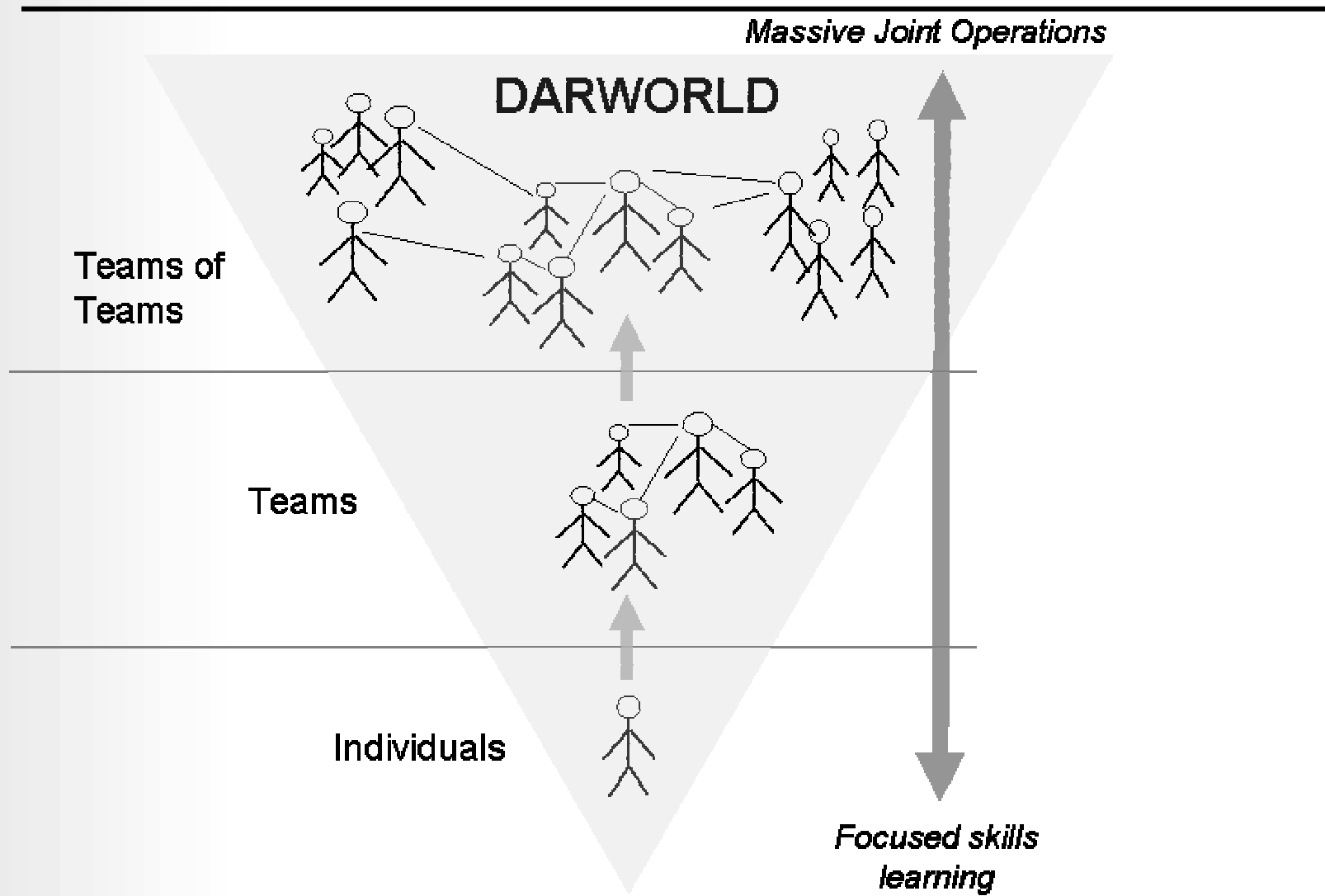
---

*“DARWARS seeks to transform military training by providing continuously available, on demand, mission-level training for all forces at all echelons.”* (<http://www.darwars.com/>)

- Users distributed globally
- Minimal equipment requirements
- Largely simulation-based
- Diverse training opportunities
- Interoperability between training systems
- Training, not just practice
- Individuals, Teams, and Teams-of-Teams



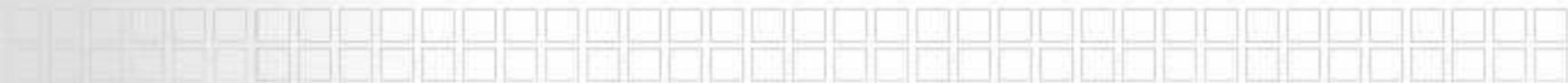
# Multi-echelon



## Gorman's Gambit

---

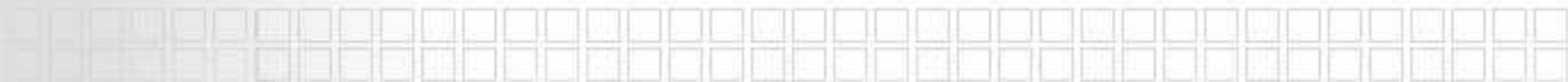
- Inspired by comments by Gen. Paul Gorman
- Basic thesis: Training on teams skills can be taught using...
  - ...COTS games
  - ...non-operational settings
- Lessons learned for development of DARWARS Joint Virtual Training Center (JVTC)
- Replicate behaviors naturally emerging in MMPG environments



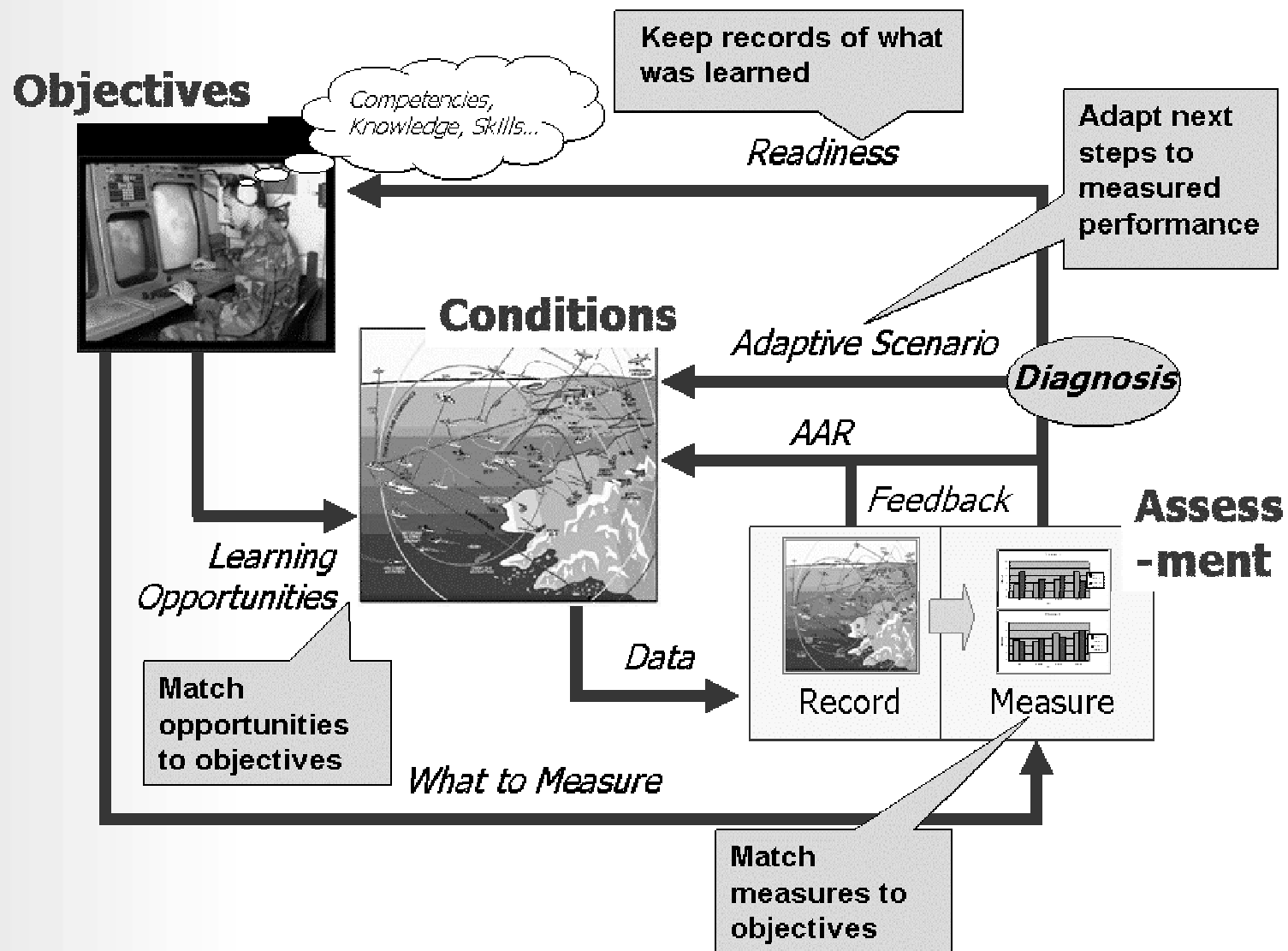
## Massive Multi-Player On-Line Role-Playing Game (MMORPG)

---

- Massive Multi-Player
  - 60+ users interacting in virtual environment
  - Potentially hundreds or thousands of users
  - Roles are differentiated
- On-Line
  - Interaction is facilitated through computer networks
  - Contrast with traditional Role-Playing games (i.e., Dungeons and Dragons)
- Role-Playing
  - Assume the roles of fictional characters (Avatars)
  - Statistically defined rules for interaction
- Game
  - “Activity engaged in for diversion or amusement” (Merriam-Webster)



# Objectives, Conditions, & Measures



# Objective: Improved Teamwork Skills (1)

<b>The Big Five Core Components of Teamwork</b>
1. Team Leadership -- The ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, develop team KSA's, motivate team members, plan and organize, and establish a positive atmosphere.
2. Performance Monitoring -- The ability to develop common understandings of the team environment and apply appropriate task strategies and processes in order to accurately monitor the teammate performance.
3. Backup Behavior -- Ability to anticipate other team member's needs through accurate knowledge about their responsibilities. Includes the ability to shift workload among members to achieve balance during high periods of workload or pressure.
4. Adaptability -- Ability to adjust strategies based on information gathered from the environment through the use of compensatory behavior and reallocation of intra-team resources; altering a course of action or team repertoire in response to changing conditions (internal or external).
5. Team/Collective Orientation -- Propensity to take other's behavior into account during group interaction and the belief in the importance of team goal's over individual member's goals.
<b>Enabling Skills</b>
A. Closed Loop Communication -- The practice of confirming receipt and understanding of others' communications. This practice builds trust in the communication skills, knowledge, and intent of others and ensures that information is accurately conveyed.
B. Team mental models -- The ability to accurately represent the capabilities of others, their responsibilities, and their perception of the state of the world.

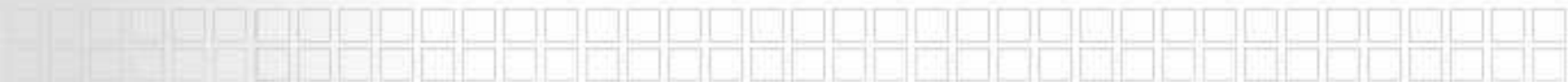
Salas, Sims, & Burke (2004)

## Objective: Improved Teamwork Skills (2)

---

- Based on Team Dimensional Training Analysis (Smith-Jentsch et al., 1998)

<b>Dimension</b>	<b>Components</b>
Information Exchange	<ul style="list-style-type: none"><li>•Utilization of all available sources of information</li><li>•Passing information to the appropriate persons prior to requests</li><li>•Providing periodic “big picture” situation updates</li></ul>
Communication	<ul style="list-style-type: none"><li>•Using proper phraseology</li><li>•Providing complete standard reports</li><li>•Avoiding excess chatter</li><li>•Ensuring clear communications</li></ul>
Supporting Behavior	<ul style="list-style-type: none"><li>•Monitoring and correcting team errors</li><li>•Providing and requesting backup when needed</li></ul>
Initiative/Leadership	<ul style="list-style-type: none"><li>•Providing guidance or suggestions to team members</li><li>•Stating clear and appropriate priorities</li></ul>



## Condition: Fantasy Setting (1)

---

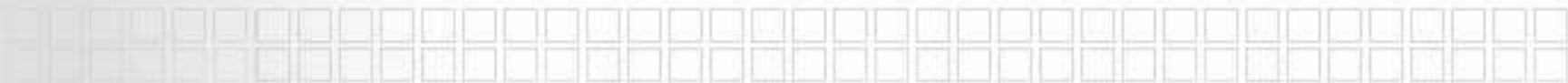
- Use fantasy setting (a la *Lord of the Rings*)
  - Existing COTS games
  - Anecdotes of emergent teamwork skills
  - Military analogs for fantasy organization structures and roles

<b>Fantasy</b>	<b>Military</b>
Scout	Infantry
Magician (Healing Potions)	Medic
Ogre	Tank
Archer	Sniper

## Condition: Fantasy Setting (2)

---

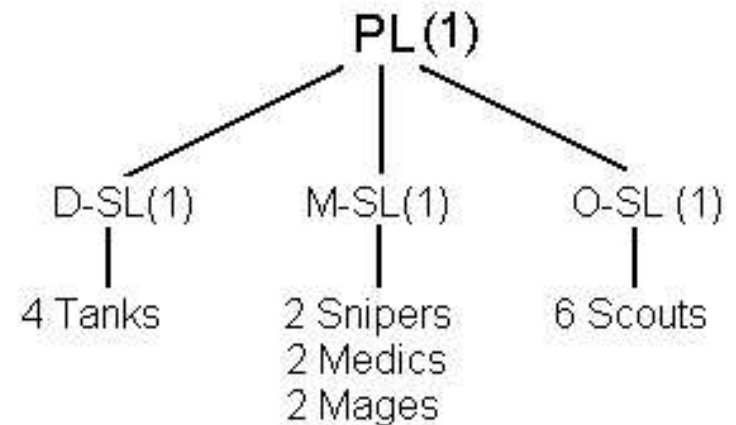
1. Demonstrate that teamwork behaviors are not environment specific, and can be practiced in alternate environments
2. Inform JVTC development, which will have a military theme
3. Mitigate the user's preoccupation with the fidelity of the simulation
  - Reduces negative transfer of skills
  - Encourages the behaviors of interest



## Condition: Scenario Development

---

- Two teams (Red vs. Blue), 20 players each
- Goal: Variations on “Capture the Flag”
- Organizational Framework
  - Hierarchical
  - Teams of Teams
  - Differentiated Roles
- Encourage teamwork behaviors emerging from effective resource management
  - Some roles (Snipers, Medics, etc) have both offensive and defensive responsibilities



# Measures: Levels of Success

---

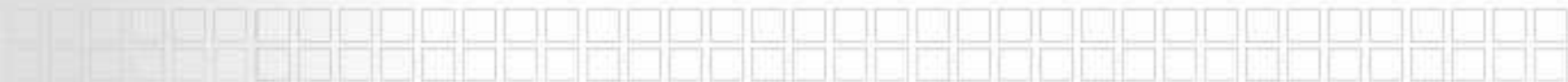
- ★ **Level 1: “Participation”** – Can we get there (military personnel simultaneously using a MPG for training)? Validates that the technical and logistic infrastructure is adequate to allow virtual exercises to occur.
- ★ **Level 2: “Subjective Relevance”** – Do players perceive that they are using and learning teamwork skills within the game. Provides evidence that training may be occurring.
- ★ **Level 3: “Transparency”** - Can we figure out what’s going on (measure training performance)? Allows for pedagogical development of a system.
- Level 4: “Confirmation”** – Can we correlate subjective experiences with objective measures (do analyses of observations corroborate perceptions)? Internally validates the functioning of the training in the environment.
- **Level 5: “Transfer”** – Is there transference of teamwork skills to other tasks (can we measure the training impact)? Proves the system effective at accomplishing its mission.



# Measures: Addressing Objectives

---

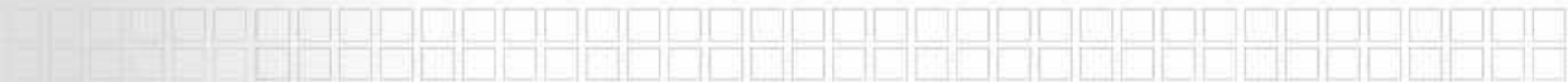
- Objective Measures
  - Task performance
  - Communications volume, direction, & content
- Observation
  - Experimenters monitor game play and note behaviors indicative of effective teamwork
  - Bounded set of behaviors for ease of recording
- Questionnaire and Interviews
  - Focused questions to glean subjective impressions



# Challenges

---

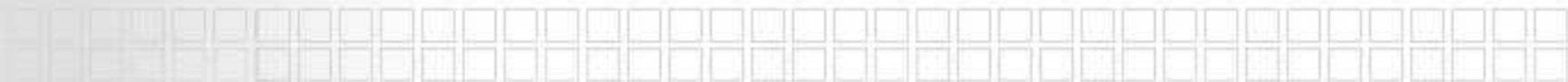
- Training Time
- Integration of tools for user collaboration
- Segregated communication channels
- Built-in measurement tools
- Role of NPCs, confederates, and monsters
- Isolated play vs. Play “in the wild” of the game
- Scenario Design Tools
- Tools for After Action Review
- Logistical Hurdles



# Planned Experimental Study

---

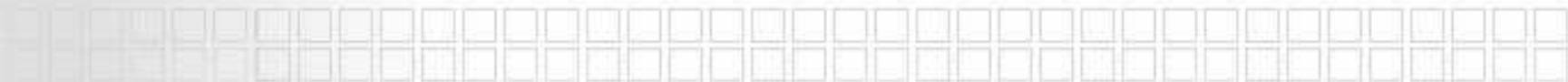
- Game: Fantasy based role-playing game
  - Moderately massive
  - Differentiated roles
  - Scenario authoring tools
- Participants:
  - ~40 networked players
  - Military personnel with infantry related experience
- Design
  - Briefing given to players 24 hours in advance
  - One day event:
    - 2 hours: Initial game training session for novices
    - 30 minutes: Review briefing, Question and answer session
    - 30 minutes: Start game and logon to server, confirm player attendance and joining, troubleshoot server issues, etc.
    - 2 hours: Game playing (possibly multiple sessions)
    - 1 hour: After Action Review (AAR)



## Lessons Learned (thus far)

---

- MMPs represent a model for implementing simulation-based training at a massive scale.
  - Large numbers of individuals
  - Differentiated Roles and Abilities
  - Multiple, simultaneous missions
- However, it is an *imperfect* model:
  - Shift focus from entertainment to training
  - Sensitive to differences in participant culture
  - There is a need for...
    - Integrated Measurement Tools
    - Incorporation of some non-RPG methods
    - Tools for planning and team coordination
    - Meaningful after-action review



---

# Thank You

