Measuring Human Performance in a Mobile Ad Hoc Network (MANET)

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### Measuring Human Performance in a Mobile Ad Hoc Network (MANET)

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C4ISR OTM Experiment Overview

2009 Campaign Goals

1. To mitigate risk for and enable **C4ISR technology development**
2. To explore engineering challenges associated with **C4ISR systems integration**
3. To define and mature metrics that quantify the **technical performance of C4ISR systems and systems-of-systems**
4. To study **cognitive impacts** of the employment of integrated C4ISR systems
5. To utilize and assess varying solutions in support of **Future Force C4ISR instrumentation, data collection & reduction**

Activities

Approach
Unified Battle Command Analysis

**Architecture**

**Battle Command Essential Capabilities**
1. Robust Network Capability
2. Execute Tactical NetOps
3. Display / Share Relevant Info
4. Standard & Sharable Geospatial Foundation
5. Enable Collaboration
6. Create and Disseminate Orders
7. Battle Command on the Move
8. Execute a Running Estimate
9. JIIM interoperability
10. Rehearsal and Training Support

**Fundamental Issues**
- What *battle command essential capabilities* are necessary at the Company and Platoon level?
- What is the *flow of data* throughout the experimental force? How well does the *network* support that flow?
- How is the quality of information available at the Company and Platoon level impacted by the *suite of available sensors*?
- How does information made available through the implemented C4ISR architecture impact the *shared situational awareness and mission execution* of the leadership at the experimental Company and Platoon level?

**UBC Early Ideas**
- Enhance collaboration with Chat across the force
- Better support stability operations by sharing low res imagery & photo/video clips between platforms and CPs
- Reduce training with common user interface
- Support flexible use of unattended sensors by providing one way guard to distribute timely intelligence information
- Reduce sustainment footprint by integrating FBCB2 onto the FCS computer
- Improve CP perimeter security operations and unmanned system training by installing FCS BC/SOSCOE at CPs
- Improve info exchange with JIIM partners by providing common office tools on platforms
System of Systems Analysis

Network Performance

System Performance

Cognitive Performance

PL to CO CDR 95.2% CR ---- Latency .29 seconds

Sensor detections, shared imagery, mixed assets

Workload, Situational Awareness, Decision Accuracy
Data Flow and Geospatial Displays

- Chat capability provided common look and feel across BC systems, allowed focus on geospatial display.

- UGS uneven performance, ranged from too little to too many spot reports -> missed detections or screen clutter.

- Multiple BC GUIs were managed easily by Soldiers who expressed high levels of experience with military and personal computer programs.

- Inputting data and managing screen is distracting from horizon scanning responsibilities.

- Sensors provided too many images, need to associate images with spot reports.
Collaboration in a Disadvantaged Network Environment

- Cross-Cueing between ground and air assets
- Universal Chat Bridge across multiple battle command applications
- Annotated UAS images
- Touch displays to facilitate planning, sensor utilization/placement and commander’s intent
- Decision aiding in robotic asset tasking, collection, and plan adjustment
• Perception of network health is critical to performance

• Need to know how systems are connected, system limitations, link status, diagnostic and correction actions.

• Network status determines choice of communication type: voice, chat, free text, image, spot report.

• Emerging role of Network Manager?
Field Study Setting

Manned and Unmanned Systems integrated in a network architecture

Urban and forested terrain

Day and Night missions

Live but scripted OPFOR

Instrumented vehicle fleet
What is the network’s impact on Soldier cognition, performance, and technology use in day/night conditions?

Comprehensive Data Collection

Triangulation Approach:
- Observations/Interviews
- Subjective ratings of workload, SA, performance
- Objective Analysis of performance

Participant Observation

Subjective Surveys

Field Interviews Day & Night

Objective Performance Analysis
Geospatial Environment for C2 Operations (GEC2O) Tool Suite

- 3D or 2D visualization of high fidelity terrain models
- Imagery and tactical data integrated with Google Earth Pro map and layer information
- Allows user to virtually fly-over or walk through area of interest

- Pre-Mission support through planning toolbox, symbols, graphics and symbology
- Live Mission support via near real time data from tactical internet overlaid on map
- Post-Mission support via playback in forward or backward at a variety of speeds and data archive
Day Mission
OPFOR arriving from West at 1847:31
OPFOR entering Vietnam Village at 1849:37