



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

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Dr. Liz Bowman, ARL CISD
Dr. Randy Zimmerman, ZCG

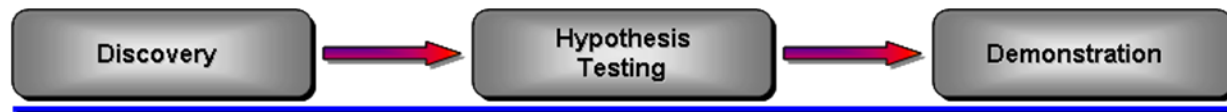
MORS Special Meeting 23-26 January 2012
Joint Framework for Measuring C2 Effectiveness

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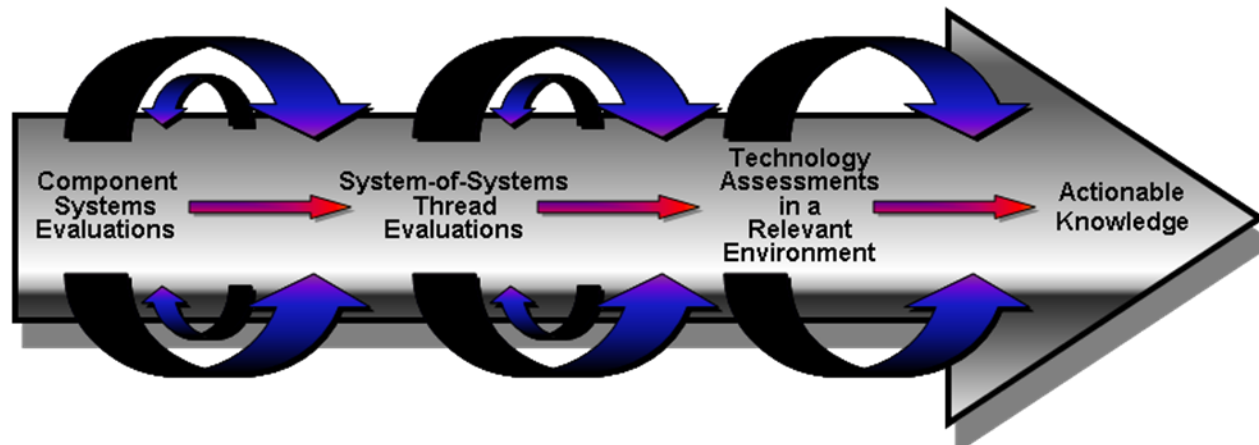
2009 Campaign Goals

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

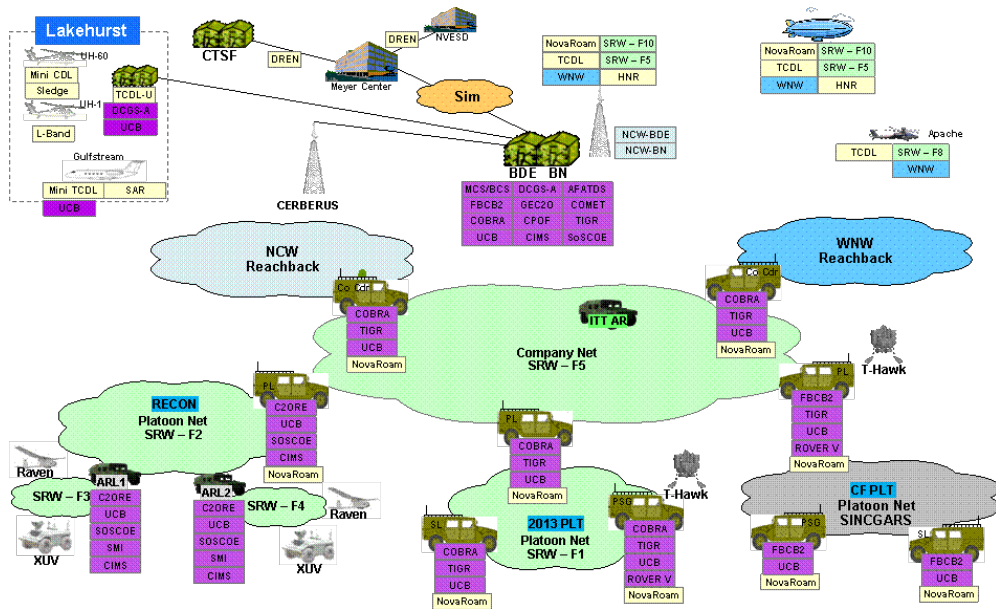


Approach



Unified Battle Command Analysis

Architecture



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?

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

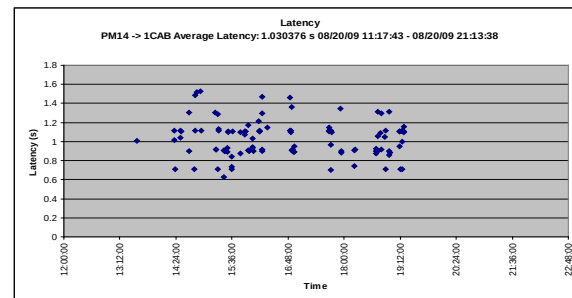
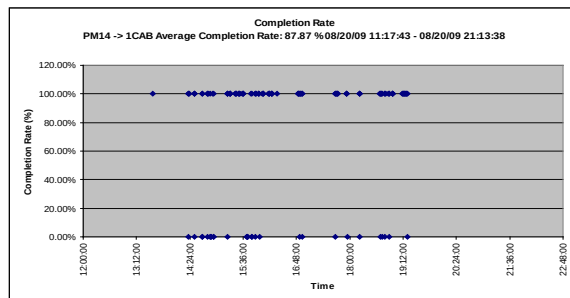
UBC Early Ideas

- 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



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

System
Performance



Sensor detections, shared imagery, mixed assets

Cognitive
Performance



Workload, Situational Awareness, Decision Accuracy

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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.



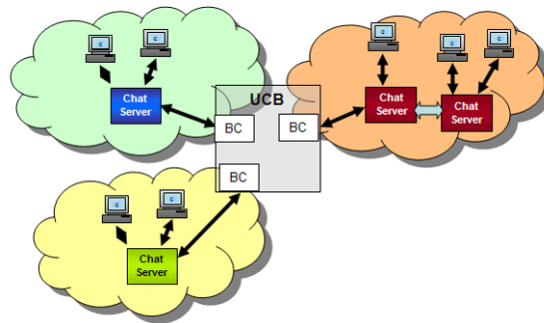
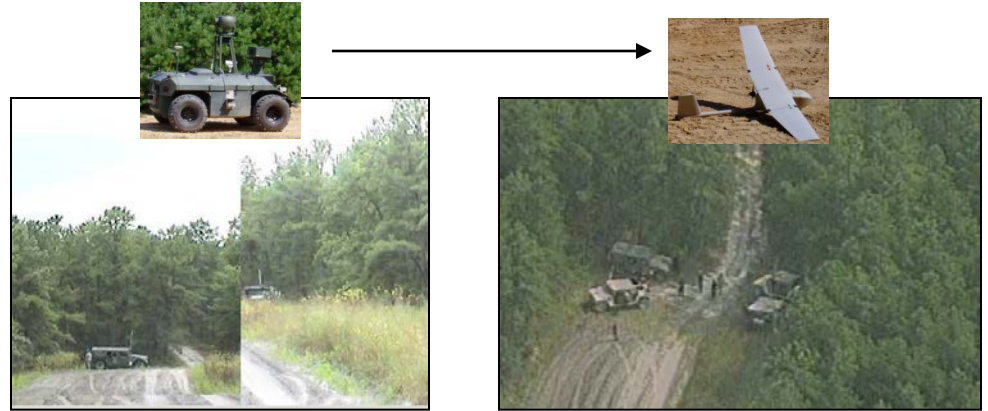
Icons*Messages*Voice*Imagery* Chat*

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Collaboration in a Disadvantaged Network Environment

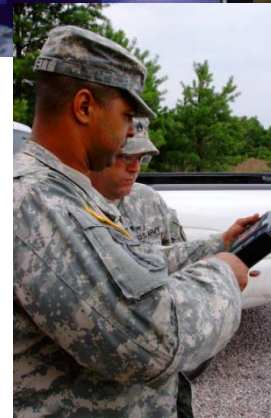
- Cross-Cueing between ground and air assets
- Universal Chat Bridge across multiple battle command applications
- Annotated UAS images
- Touch displays to facilitate planning, sensor utilization/placement and commander's intent
- Decision aiding in robotic asset tasking, collection, and plan adjustment



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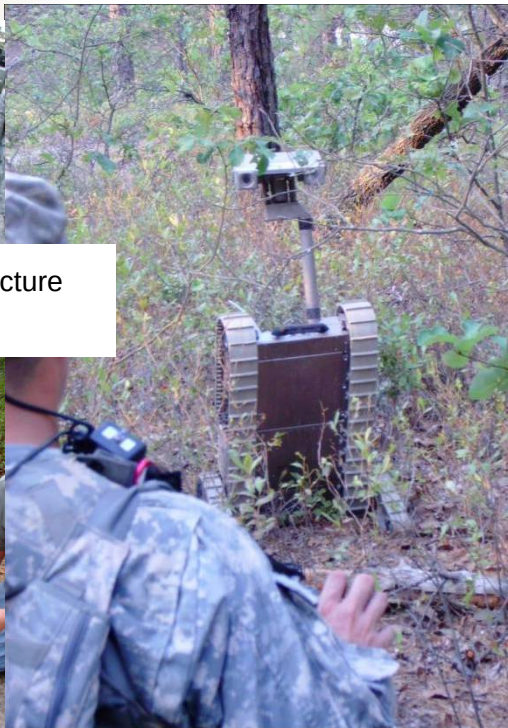
Extension of Network to Lower Tactical Elements

- 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

Comprehensive Data Collection

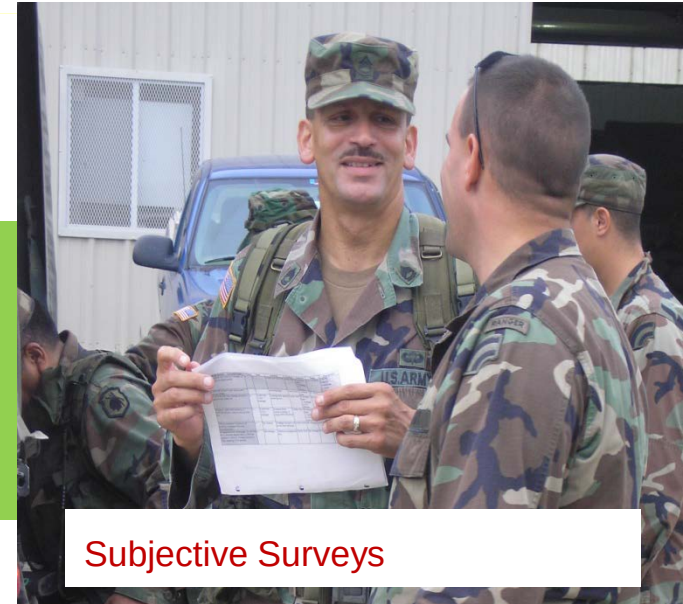


Participant Observation



Triangulation Approach:

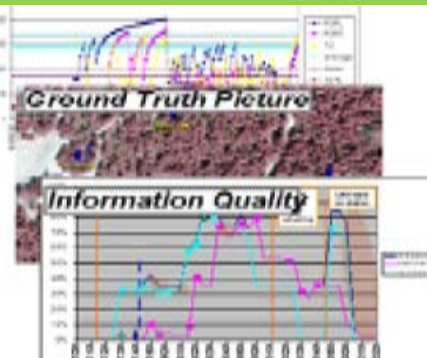
- Observations/Interviews
- Subjective ratings of workload, SA, performance
- Objective Analysis of performance



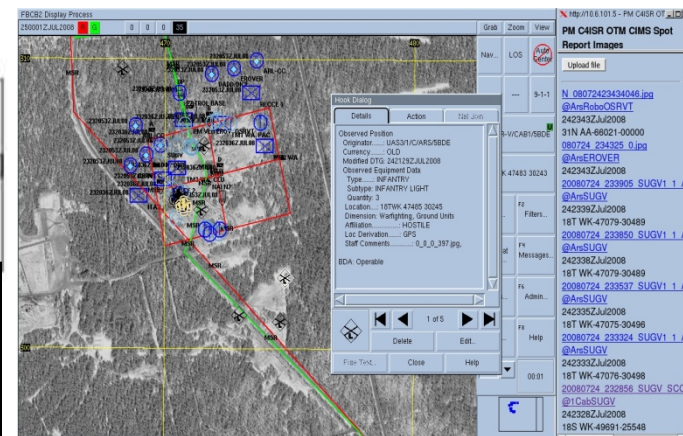
Subjective Surveys



Field Interviews Day & Night



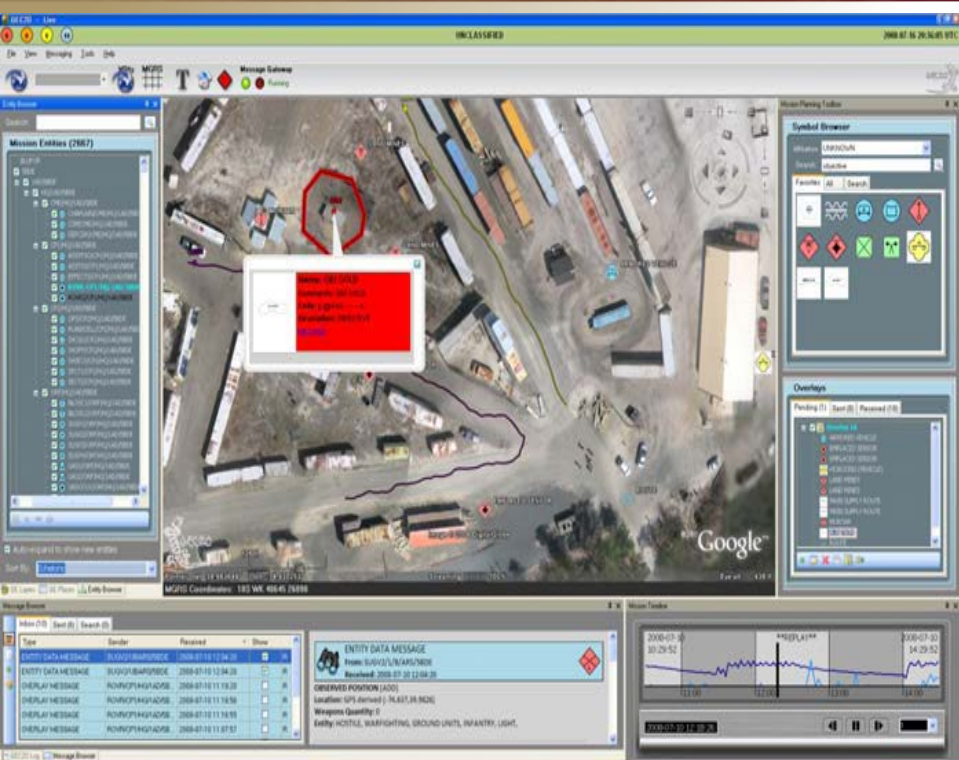
What is the network's impact on Soldier cognition, performance, and technology use in day/night conditions?



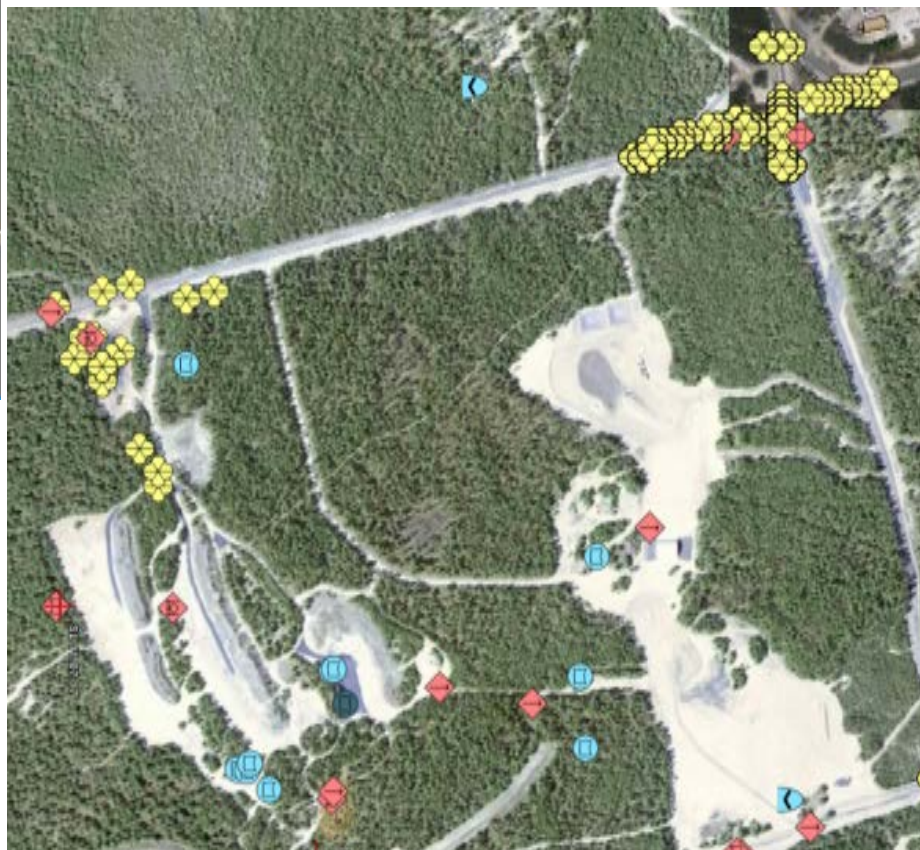
Objective Performance Analysis



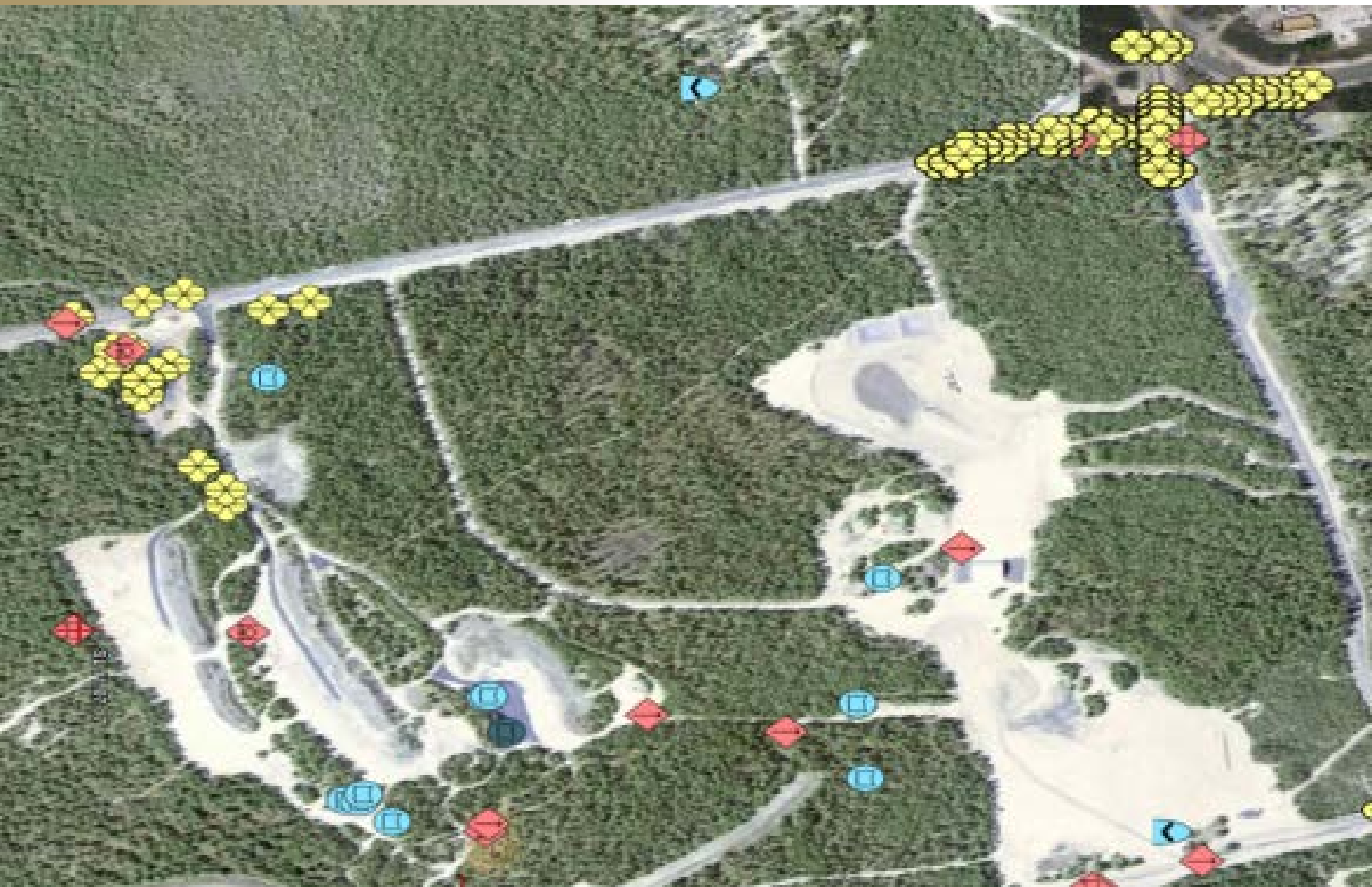
Geospatial Environment for C2 Operations (GEC2O) Tool Suite



- 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





GEC2O Screen Shots

GEC2O -- July 29 2008b

UNCLASSIFIED

2008-09-05 13:22:24 UT

File View Messaging Tools Help

Message Gateway

Day Mission
OPFOR arriving from West at
1847:31

Message Browser

Inbox (54) Sent (0) Search (0)

Type	Sender	Received	Show	
ENTITY D...	2TUGS...	2008-0...	☒	R
ENTITY D...	2TUGS...	2008-0...	☒	R
ENTITY D...	2TUGS...	2008-0...	☐	R
ENTITY D...	2TUGS...	2008-0...	☒	R
ENTITY D...	1TUGS...	2008-0...	☒	R
ENTITY D...	2TUGS...	2008-0...	☒	R
ENTITY D...	1TUGS...	2008-0...	☒	R
ENTITY D...	UAS/S...	2008-0...	☒	R
ENTITY D...	UAS/S...	2008-0...	☒	R
FREE TE...	PL-V11/...	2008-0...	☐	R
FREE TE...	BNCD...	2008-0...	☐	R
FREE TE...	PL-V11/...	2008-0...	☐	R
FREE TE...	PL-V11/...	2008-0...	☐	R
FREE TE...	PL-V11/...	2008-0...	☐	R

FREE TEXT

From: PL-V11/A/ARS/5BDE

Received: 2008-07-29 18:43:25

Subject: blue salute

s-possible nuclear device a- in back of vehicle l- hmmmww on objective... bumper # PM-36, vic bldg A1 u- n/a t-1837 e- possible nuclear device

Mission Timeline

2008-07-29 17:00:00

2008-07-30 01:00:00

REPLAY

18:00 20:00 22:00 00:00

2008-07-29 18:47:31

© 2008 Tele Atlas
Image © 2008 DigitalGlobe

Streaming ||||| 100%

Eye alt 1532

OPFOR entering Vietnam Village at 1849:37



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Image © 2008 DigitalGlobe

Pointer 39°58'39.71" N 74°24'59.31" W
MGRS Coordinates: 18S WK 49814 25452

Streaming 100%

Eye alt 1532

Message Browser

Inbox (54) Sent (0) Search (0)

Type	Sender	Received	Show
ENTITY D...	2TUGS...	2008-0...	☒ R
ENTITY D...	2TUGS...	2008-0...	☒ R
ENTITY D...	2TUGS...	2008-0...	☐ R
ENTITY D...	2TUGS...	2008-0...	☐ R
ENTITY D...	1TUGS...	2008-0...	☒ R
ENTITY D...	2TUGS...	2008-0...	☒ R
ENTITY D...	1TUGS...	2008-0...	☒ R
ENTITY D...	UAS/S...	2008-0...	☒ R
ENTITY D...	UAS/S...	2008-0...	☒ R
FREE TE...	PL-V1/...	2008-0...	☐ R
FREE TE...	BNCD...	2008-0...	☐ R
FREE TE...	PL-V1/...	2008-0...	☐ R
FREE TE...	PL-V1/...	2008-0...	☐ R
FREE TE...	PL-V1/...	2008-0...	☐ R

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GE20 Log Message Browser

Mission Timeline

2008-07-29 17:00:00

2008-07-30 01:00:00

REPLAY

2008-07-29 18:48:05