Urban Battlespace Control: A New Concept for Battle Command

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Battlespace Terrain Ownership

- Battlespace Terrain Ownership (BTO) computes control based on combat power projection as a function of position, asset distribution, weapon system effectiveness, probabilities of hit and kill, and damage

- A dynamic diagram updated as a battle progresses to aid the commander in timely prediction of crucial events

- The prototype is currently linked into streaming data from One Semi-Automated Forces (OneSAF) combat simulation to demonstrate ownership display

Battlespace Data

- Modified OneSAF to produce data files containing both force interactions (combat) and entity status (logistics)
- Developed a Southwest Asia scenario depicting a company-sized assault on a numerically superior defense
- Prototype tested on open terrain conflict

Assumptions

- Friendly (Blue) and Opposition (Red) force entity status and position are noted as they change
- For a given entity, any enemy entity may occupy a partitioned area being considered
- Each entity may fire whatever rounds are available
- Knowledge of opposition weapon systems and capabilities

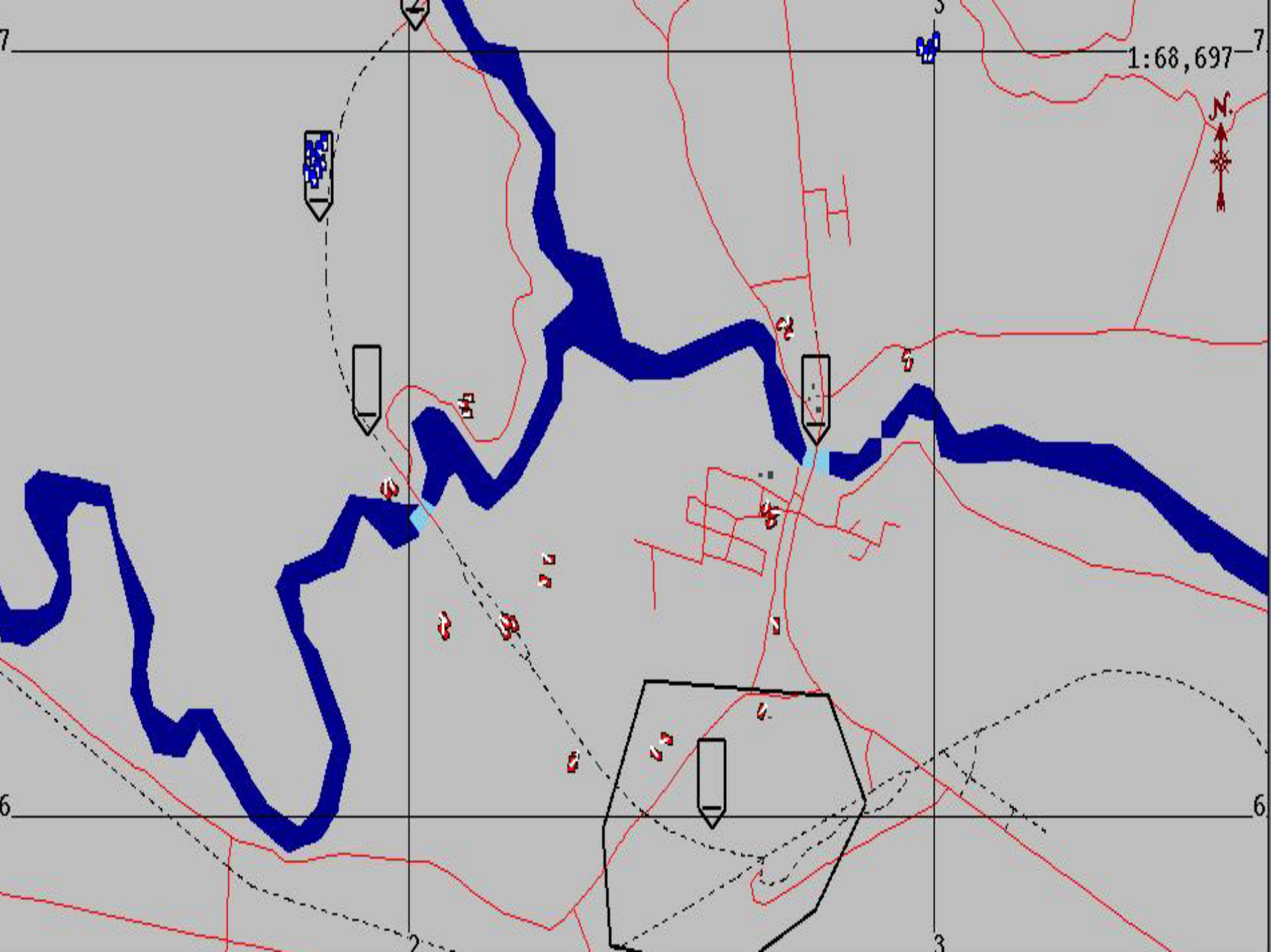
BTO Algorithm

- Partitions the battlefield into a number of rectangular areas for individual examination and determines the collective power that each force is able to project onto an individual area

- Seven classifications of power ratios:
  - >= 6:1 (Blue and Red)
  - >= 3:1 and < 6:1 (Blue and Red)
  - >= 1:1 and < 3:1 (Blue and Red)
  - A zero owned class (due to weapon range restrictions)

- Areas for each class are color coded and plotted

- Also have probability of various kill types (M, F, MF, K) given a hit for each type round against each type vehicle, as a function of range, round dispersion, angle of attack, and hit location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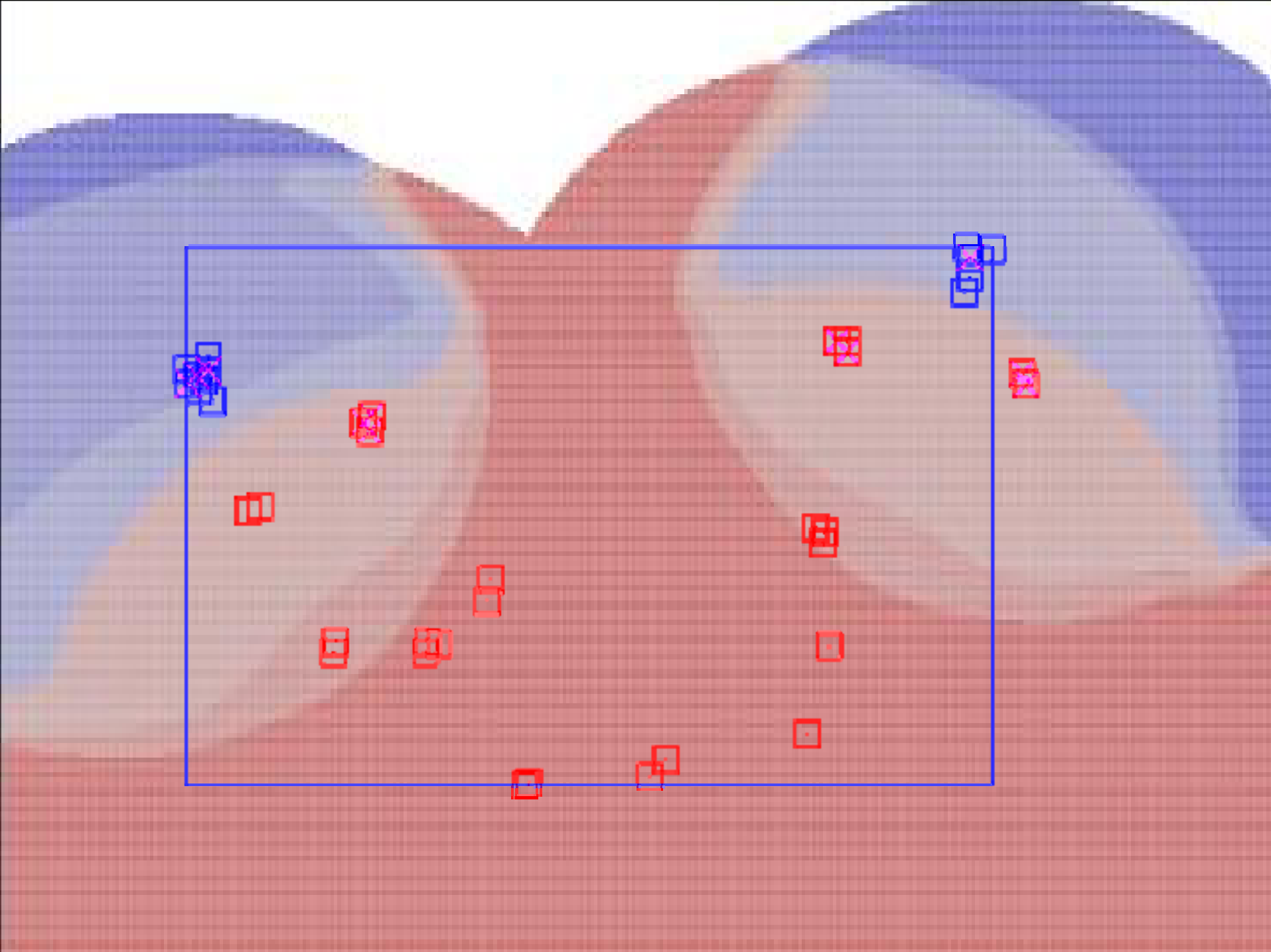

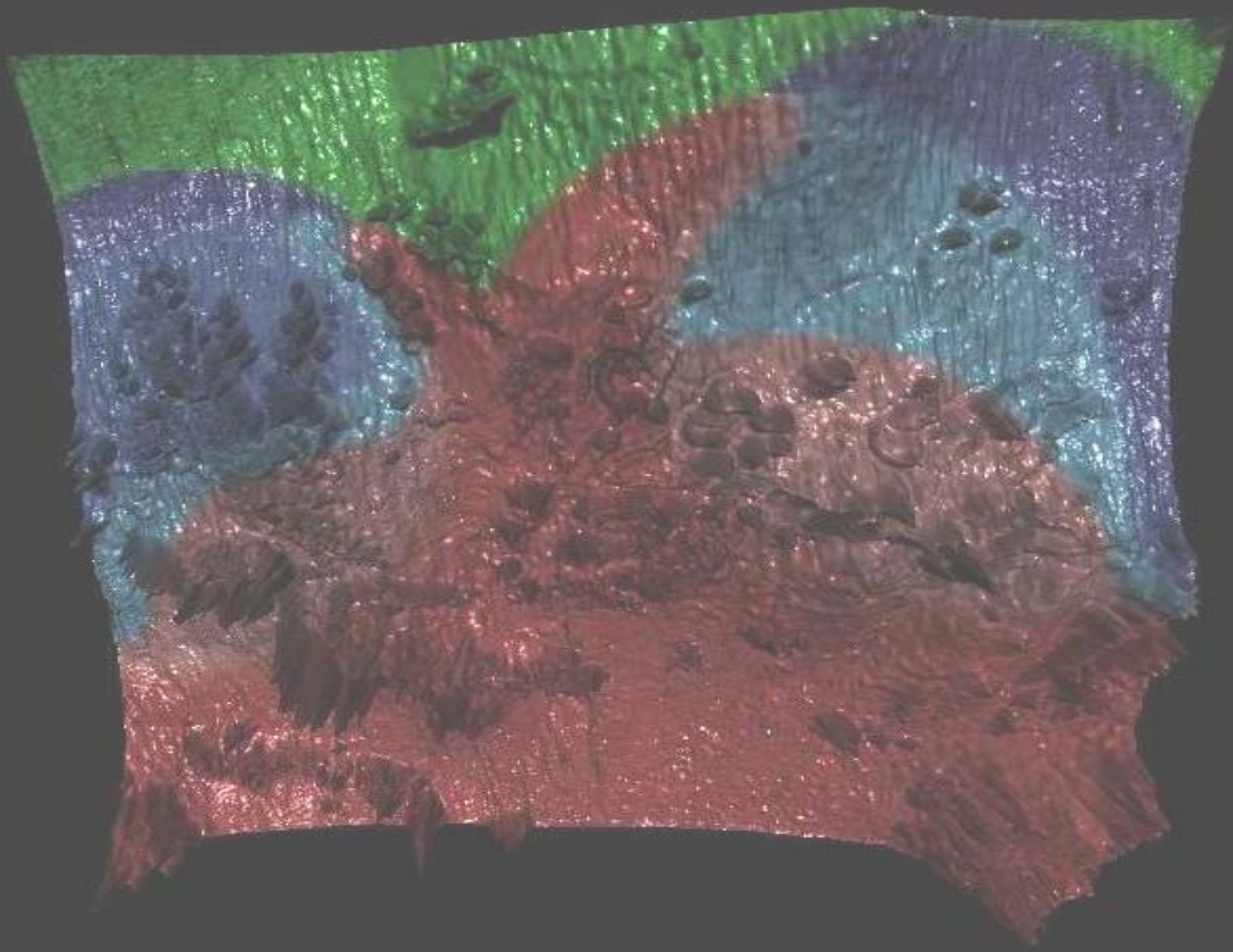

BTO Enhancements

Completed

- Created JAVA GUI to launch OneSAF and BTO
- Ported BTO to Linux environment
- Improved OneSAF interface to reduce amount of human interaction necessary for data collection
- OneSAF modified to report indirect fire events
- Demonstrated BTO at Ft. Leavenworth for input on features and improvements

In Progress

- Developing overlay so ownership graphic will display on map
- Creating ownership algorithm for urban environments

Urban Conflict

- Complex and multi-dimensional
- Societal characteristics
- Produces food and water shortages, pollution, and disease
- Criticality of urban infrastructure
- Military decision-making factors tend to be compressed
- Population has a greater effect

Urban Classifications

- Offensive
  - Surprise, boldness, and force concentration
- Defensive
  - Preparation, security and adaptability
- Stability and Support
  - Interactions between civilian populations and organizations

Interviews

- Nine SMEs at Battle Command Battlelab – Ft. Leavenworth
- Showed BTO open terrain demonstration
- Asked for input on improvements to BTO
- Asked for input on how to modify BTO for urban conflict

Urban Recommendations – Interview Results

- Criticality of personal involvement
- Socioeconomic data
- Presence may afford more control than firepower
- Importance of dismounted infantry
- Modeling of infrastructure elements, man-made obstructions, force degradation

Urban Visualization

- Use scaleable Vector Graphics (SVG) for 2D display
- Generate a transparency of ownership with accurate registration for 3D display using Java3D Application Interface
- Provide rapid update of ownership data in SVG by scripting the document object model (DOM) for the Apache Software Foundation Batik Viewer

Urban Line of Sight (LOS)

- New LOS algorithm created for open terrain BTO
- Partitions battlespace into rectangular grid
- Elevations are represented as quadratic polynomials
- To determine obstructions, solve the quadratic polynomial
- Smoothing of open terrain
- May not improve urban LOS

Urban Challenges

- Inadequate algorithms for dynamic information push/pull
- Inadequate environmental algorithms to support analysis
- Metrics to evaluate if battle command capabilities are enhanced
- Decision aids are not good at handling mixed assets – sensors, robots, and soldiers

The Road Ahead

- Identify urban COA measures of effectiveness
- Mission abstractions
- Wargaming parameters
- Modify power projection algorithm to include urban factors
- Improved Urban LOS?
- Improved visualization
- **Other Suggestions?**

Conclusion

BTO enables a real-time visualization of the battlespace, presented without excessive details, to help the commander recognize force potentials and terrain control in battle monitoring and execution. This capability must be extended to the urban environment.

Questions?

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