19th International Command and Control Research and Technology Symposium

DESIGN OF A MULTI-TOUCH TABLETOP FOR SIMULATION-BASED TRAINING

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THE ORCHESTRATING MILITARY SIMULATION (ORMIS) PROJECT

A collaborative tabletop-based tool to support **simulation based training**

2 years of design and development in collaboration with

Défense nationale National Defence

THALES

Goal of this talk:

1. Show the **potential of tabletop based interfaces** to ease simulation-based training exercises
2. Illustrate that simply relying on a tabletop-based interface is **not sufficient**

SIMULATION-BASED TRAINING

Radio, Chat, GPS

PRIMARY TRAINING AUDIENCE
in a simulated command headquarters

TROOPS
on the battlefield

SIMULATION-BASED TRAINING

Simulated

Radio, Chat, GPS

PRIMARY TRAINING AUDIENCE

in a simulated command headquarters

INTERACTORS

roleplay troops on the battlefield with simulation tools

SIMULATION-BASED TRAINING ADVANTAGES

- **Inexpensive** mounting of large-scale exercises by avoiding the costs of field deployments
- **Enable actions** that cannot normally be performed repeatedly in real-world collective training (e.g. blowing-up buildings)
- Allows officers to be trained **frequently**

BUT...

the quality of the training experience highly depends on the ability of **interactors** to perform a realistic and educationally beneficial scenario.

EXISTING TOOLS

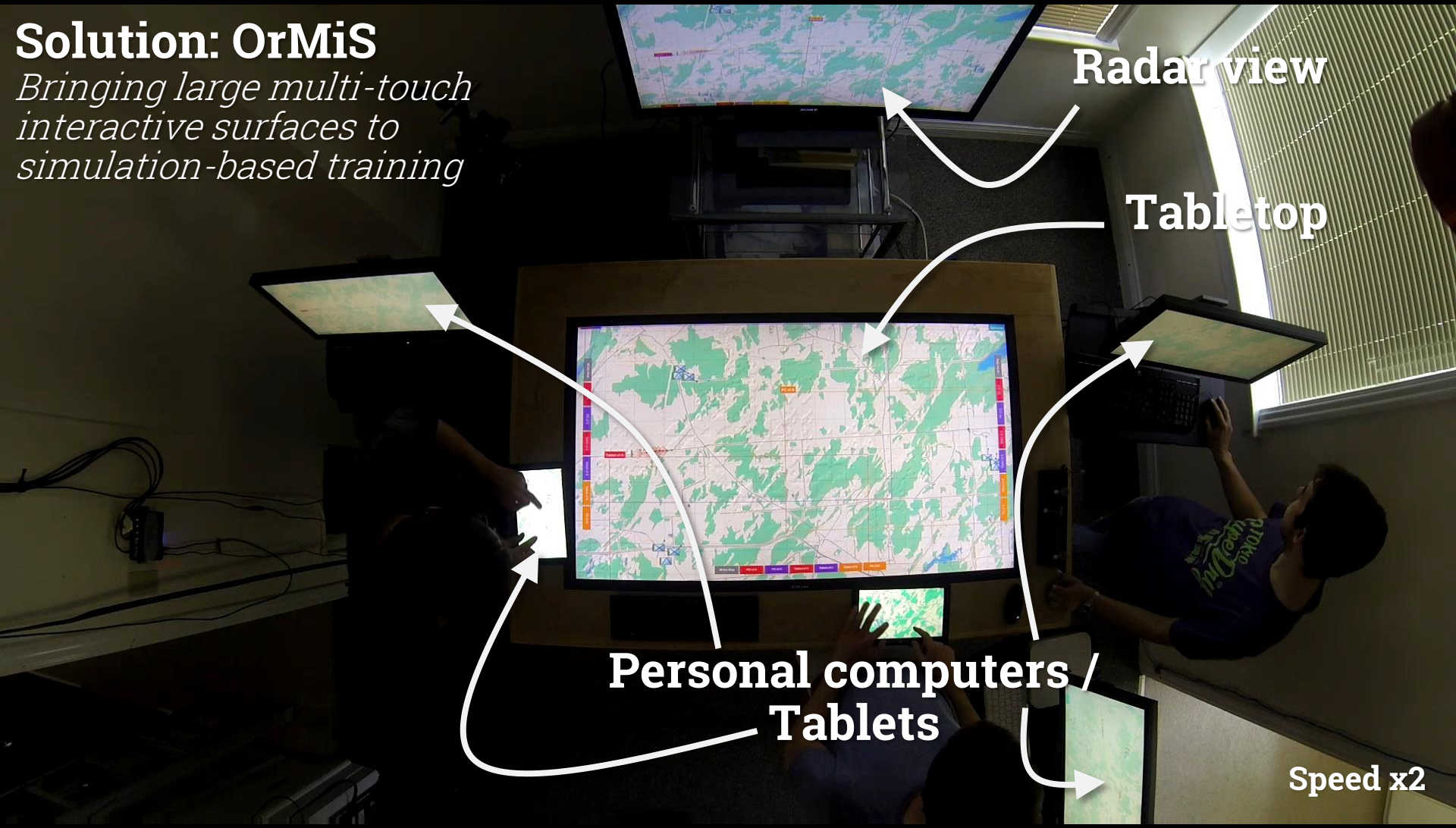
- PC-based Software
  - ABACUS (Advanced Battlefield CompUter Simulation)
  - JCATS (Joint Conflict And Tactics Simulation)
- Analysis of Issues with the existing tools
  - In-situ observations
  - Task analysis
  - Interviews with interactors and simulation experts

PROBLEMS WITH EXISTING TOOLS

1. Interface complexity

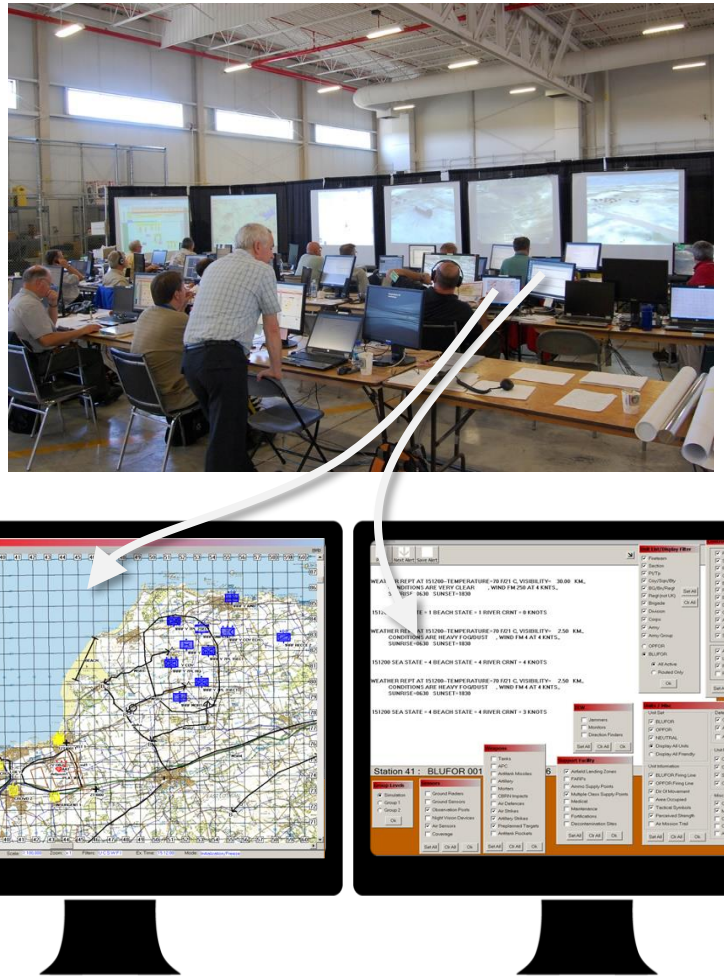
2. Weak support for coordinated tasks

3. Poor flexibility when plans need to change


Solution: OrMiS
Bringing large multi-touch interactive surfaces to simulation-based training
Radar view
Tabletop
Personal computers
Tablets
Speed x2

1. INTERFACE COMPLEXITY

- Interface problems
  - Too many controls on separated windows
  - Complex access to basic features
  - Poor visualization tools (e.g. Line of sight)
- Impact on the simulation
  - Training costs
  - Scalability problems

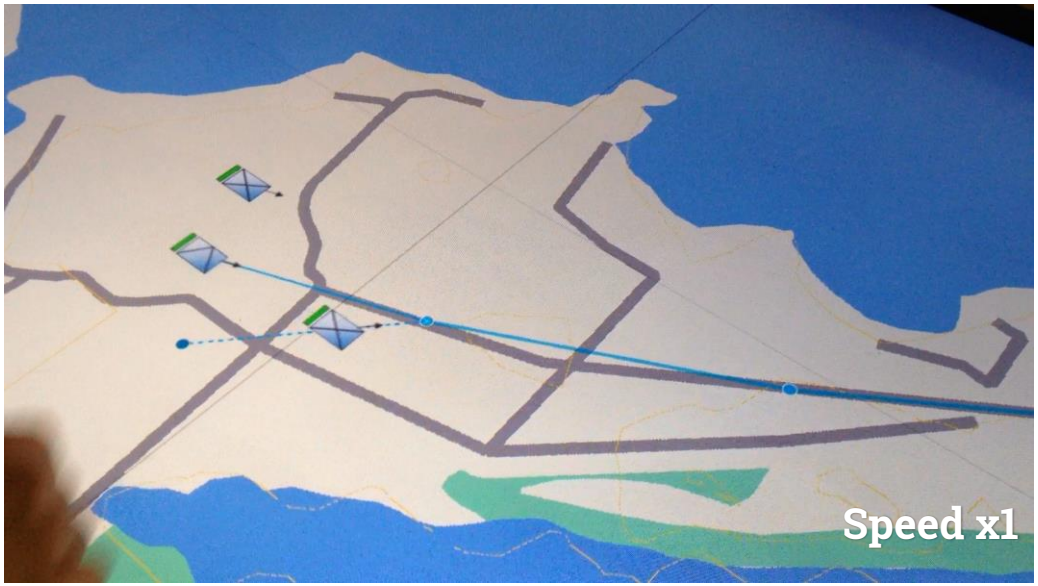


The ABACUS interface

1. INTERFACE COMPLEXITY

OrMiS solution: example 1 - route planning

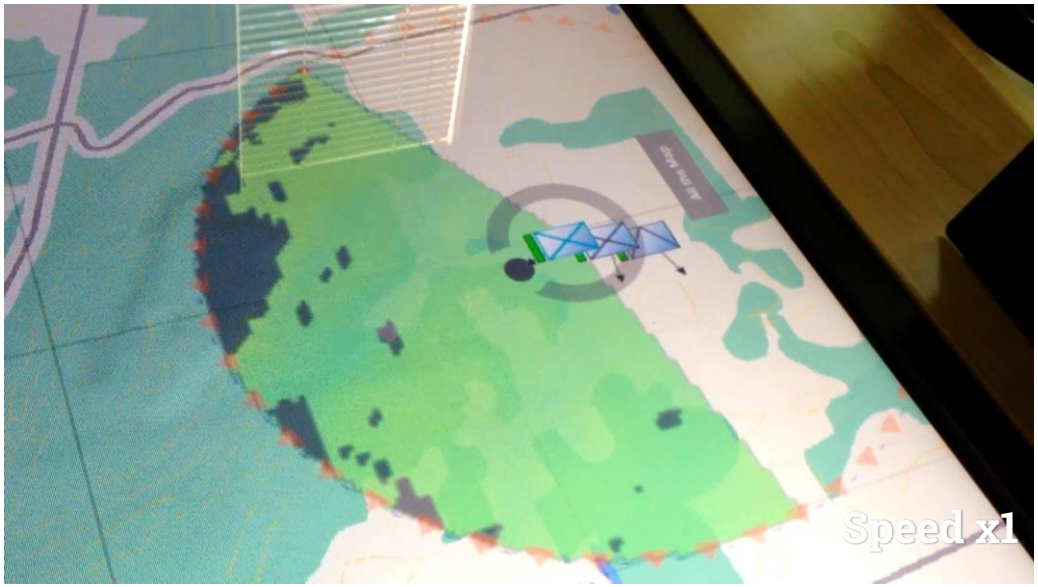
1. Simple drag technique to create a route
2. Contextual pie menus instead of external windows
3. Animations that provide cues about the state of the units and routes



1. INTERFACE COMPLEXITY

OrMiS solution: Example 2 - Line of sight visualisation

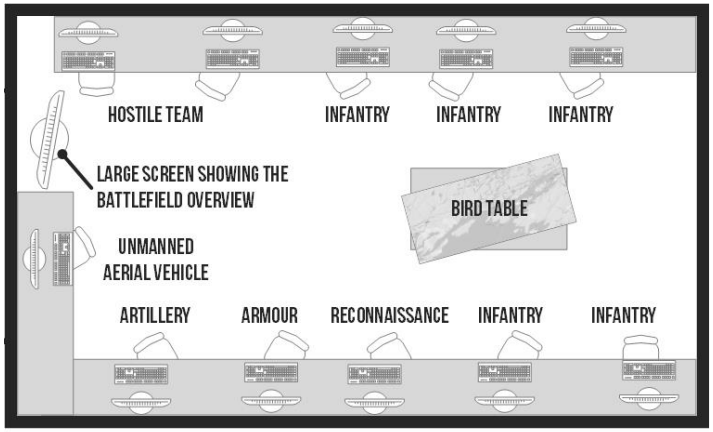
1. Simple tap to access visualization tools
2. Real time computation at a low resolution
3. Simple touch technique to reorient units



2. WEAK SUPPORT FOR COORDINATED TASKS

- Coordination and awareness issues
  - Communication limited with the pc-based physical setting
  - Tightly coordinated scenarios are difficult to perform

- Impact on the simulation
  - Very limited awareness between interactors
  - Tightly coordinated scenarios require unit reassignments



2. WEAK SUPPORT FOR COORDINATED TASKS

- OrMiS supports communication with multiple space-sharing techniques

2. WEAK SUPPORT FOR COORDINATED TASKS

Shared table: ideal for tightly coordinated scenarios in a limited area

Advantages

1. Provide mutual awareness
2. Enable simultaneous work on the same area of the map
3. Adapted to tightly coordinated actions

Inconvenient

1. Simultaneous users are limited by the size of the table

2. WEAK SUPPORT FOR COORDINATED TASKS

Bifocal lenses: ideal for maintaining high awareness while working on different areas

Advantages

1. Able to work with a high level of detail, without interfering with others
2. Indicates the part of the map your partners are working on
3. Keeps its position when using the main zoom

Inconvenient

1. Can overlap when working closely

2. WEAK SUPPORT FOR COORDINATED TASKS

Viewports: ideal for working simultaneously in a decoupled manner on the map, while maintaining low awareness.

Advantages

1. Can be reoriented
2. Able to reach distant parts of the map
3. Not influenced by main zoom

Inconvenient

1. Provide low awareness

2. WEAK SUPPORT FOR COORDINATED TASKS

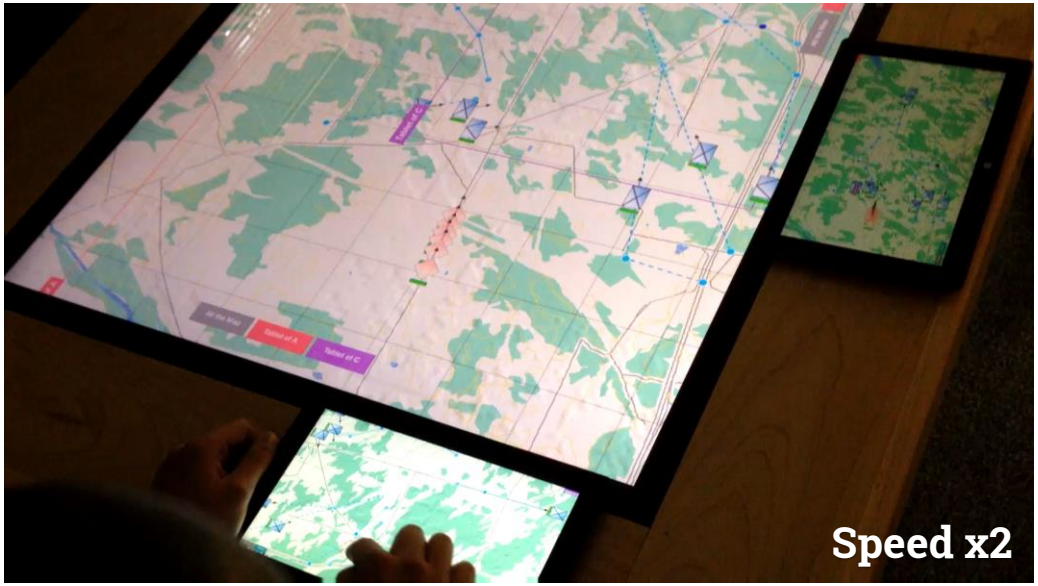
PC/Tablets: ideal for individual work and low awareness

Advantage

1. Offers higher degree of privacy
2. Does not take away any screen real estate from the main map
3. Provides a high input/output resolution

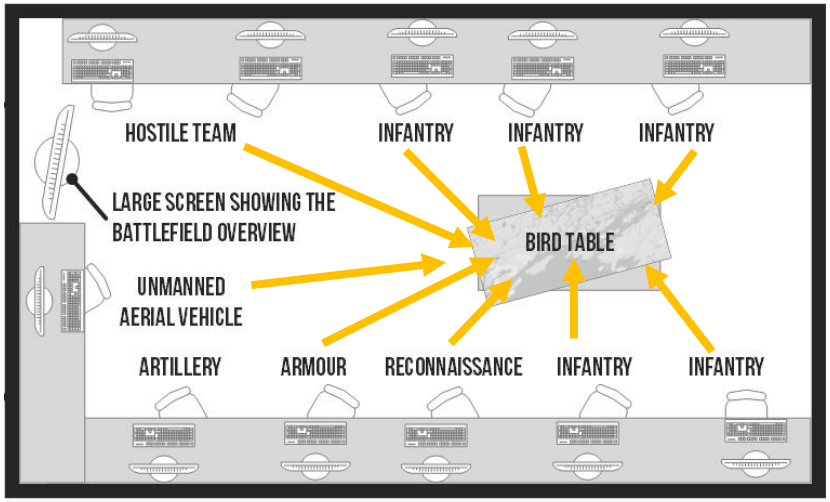
Inconvenient

1. Poor awareness of others' actions



3. POOR FLEXIBILITY WHEN PLANS NEED TO CHANGE

- Unexpected events may occur
  - Need to leave their desk
  - Gather around the map table
  - Reposition pieces of paper representing units on the paper map
- Impact on the simulation
  - Breaks the workflow
  - Requires one interactor to monitor the simulation in the meantime



3. POOR FLEXIBILITY WHEN PLANS NEED TO CHANGE

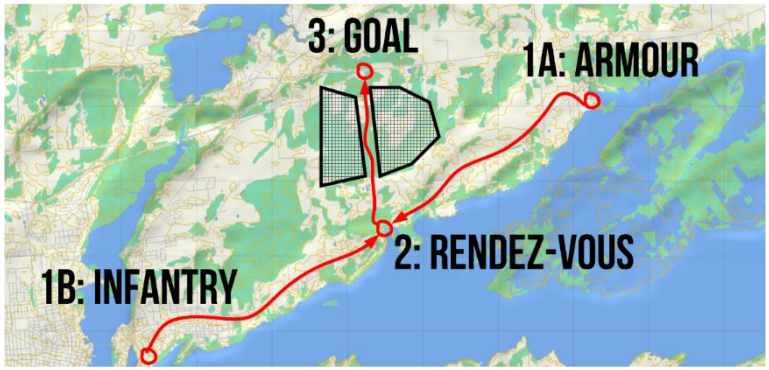
1. Switch between simulation and planning in a second
2. Tablets positioned around the table to monitor the simulation
3. No need to update the position of units

HOW ORMIS SOLVES EXISTING PROBLEMS

1. Interface complexity	**Solved:** with simple touch based interaction techniques
2. Weak support for coordinated tasks	**Solved:** by providing a shared space supporting various types of collaboration couplings
3. Poor flexibility when plans need to change	**Solved:** by enabling rapid switching between planning and running the simulation

EARLY FEEDBACK ABOUT ORMIS

- Early qualitative study
- 6 pairs of officer candidates Royal Military College, Kingston, ON
- Procedure
  - Short training (< 15 min)
  - Simple scenario
  - Interviews / questionnaires



RESULTS

- Effectiveness: users were able to perform the task successfully with minimal (< 15 min) training

- Users were very enthusiastic about OrMiS
  - *“I really liked the table, it was very intuitive”*
  - *“…for planning the route, I found it was actually pretty good!“*
  - “*when we clicked it would tell us if it was water, road, etc. and that was really handy. I liked that.*”

- The tested techniques obtained very good usability results with the SUS standard*

* Brooke, J. (1996). SUS - A quick and dirty usability scale. In A. Jordan, Patrick, W., Thomas, Bruce, Weerdmeester, Bernhard, A., McLelland, Ian (Ed.), Usability Evaluation in Industry (pp. 189–194). CRC Press. doi:10.1002/hbm.20701

SOME LESSONS LEARNED

- Need to limit the risk of interferences

  "*[we] had to create a seniority of who was allowed and who was in control of the board, because at some points I would go touch something and it would screw him up, … so we had to have one person who would say don't touch it until I'm done*".

- Ergonomic considerations

  "the table should be higher or angled … there is clearly one side that's better"

CONCLUSIONS

- Tabletop based interfaces are a promising solution to ease simulation-based training exercises
  - Minimal training
  - High awareness
  - Support for tightly coupled collaborative tasks

- But…
  - Simply relying on a multi-touch table is not sufficient
  - Need to support various types of collaboration coupling

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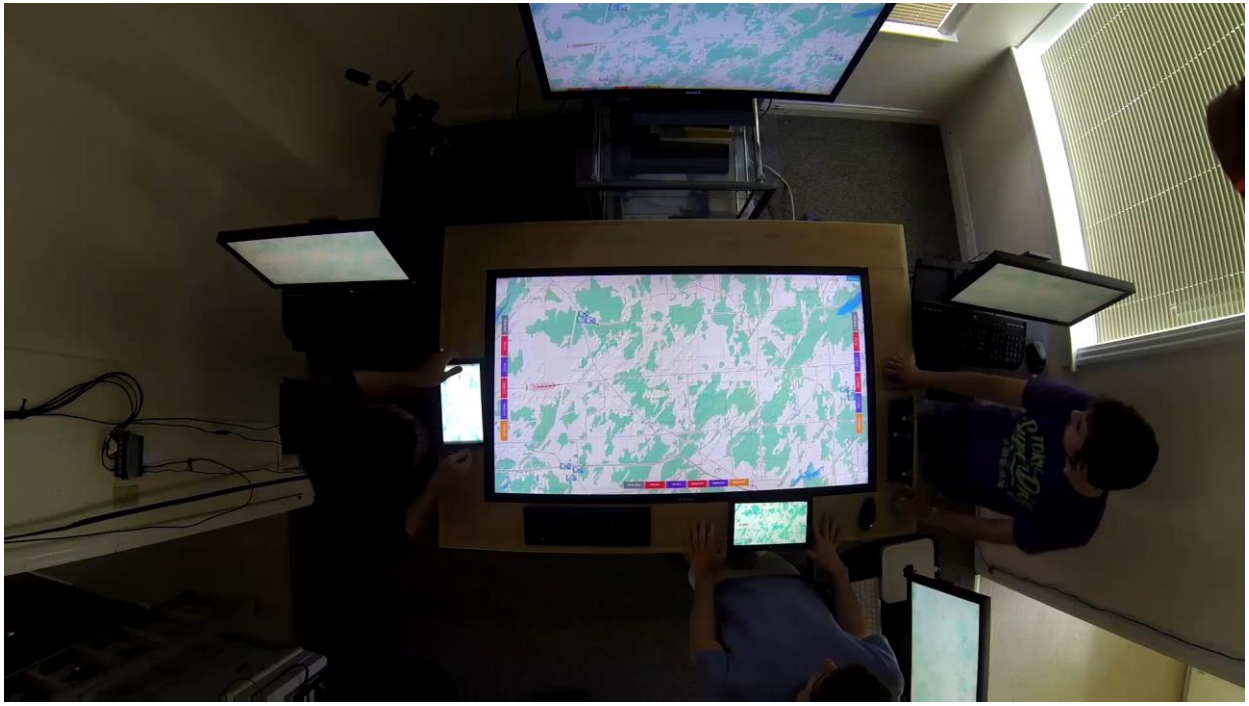

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