

Battlefield Visualization on the Responsive Workbench

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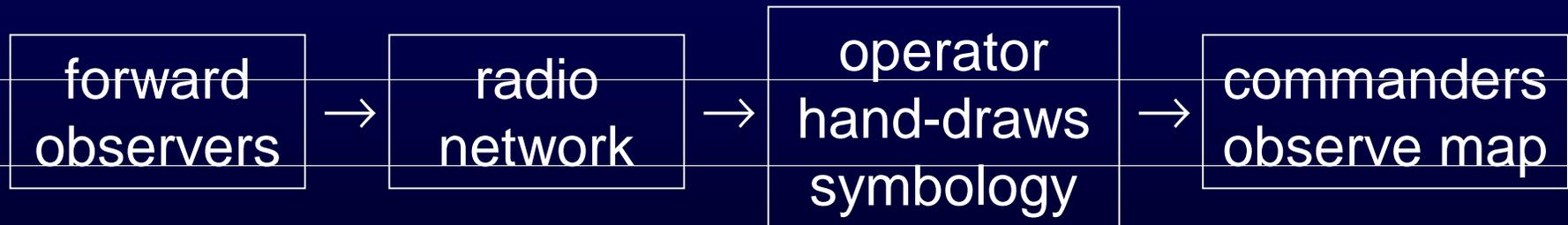
The Virtual Reality Laboratory
The Naval Research Laboratory
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Battlefield Visualization

old as warfare itself

ancient warfare: sandbox with models

this century: paper maps under acetate



past decade: operator hand-enters data into computerized battlefield visualization system

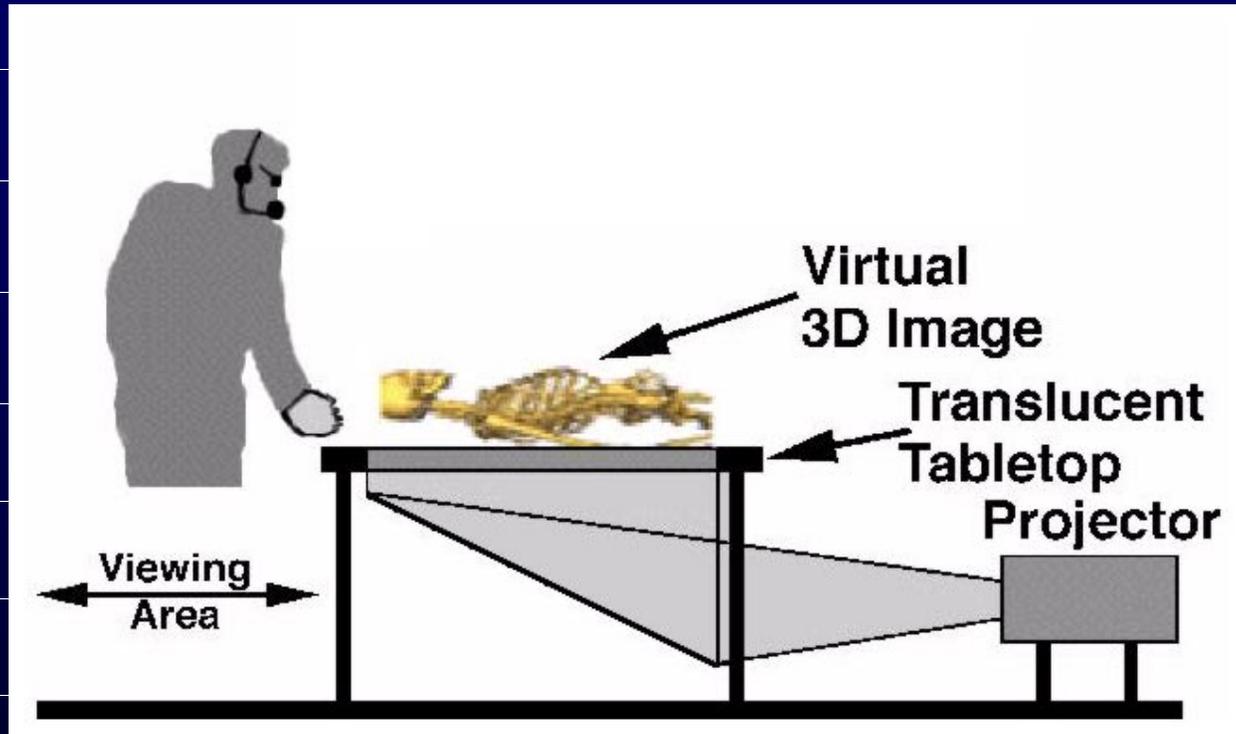
currently: encrypted networks allow data entry by forward observers

The Dragon System



3D Battlefield Visualization System

Dragon on Responsive Workbench

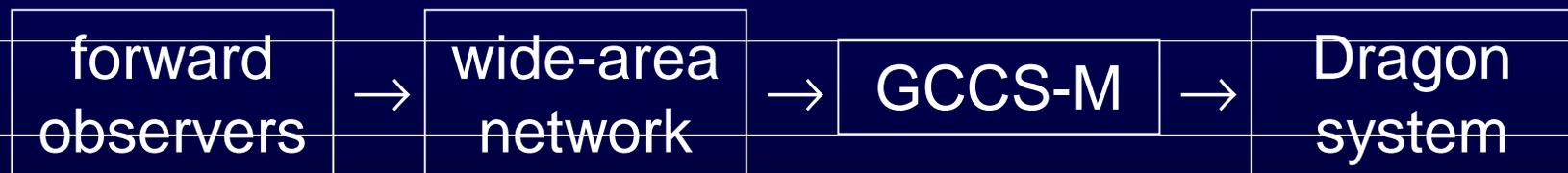


- VR Lab early developer of the workbench
- good for tasks that:
 - need partially (not fully) immersive environment
 - typically performed around a table

Field Exercises

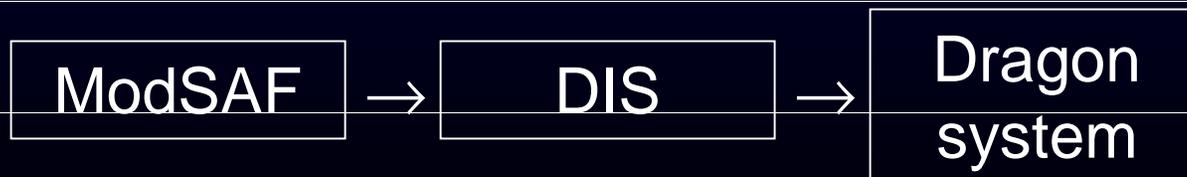
Hunter Warrior (march 1997)

- testing advanced infantry technology
- **Dragon** used in command center



Joint Counter Mine (august & september 1997)

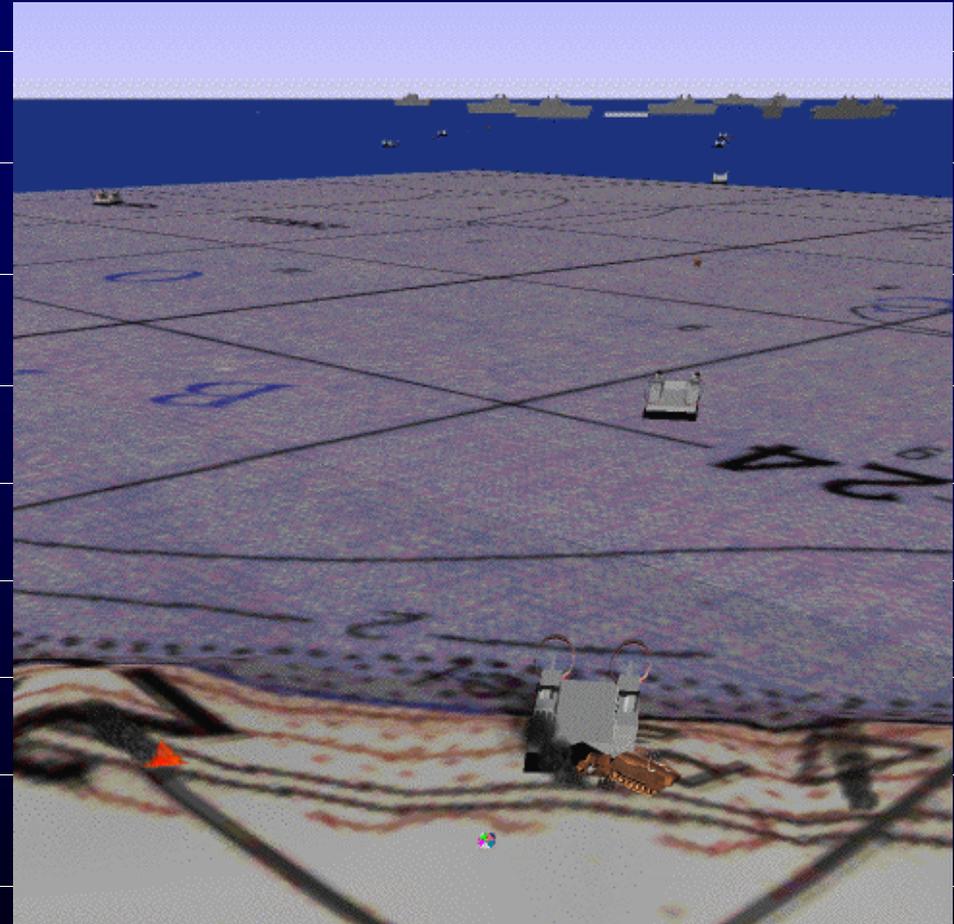
- land mine avoidance/removal during beach landing
- **Dragon** used with advanced simulation system



Field Exercise Screen Shots

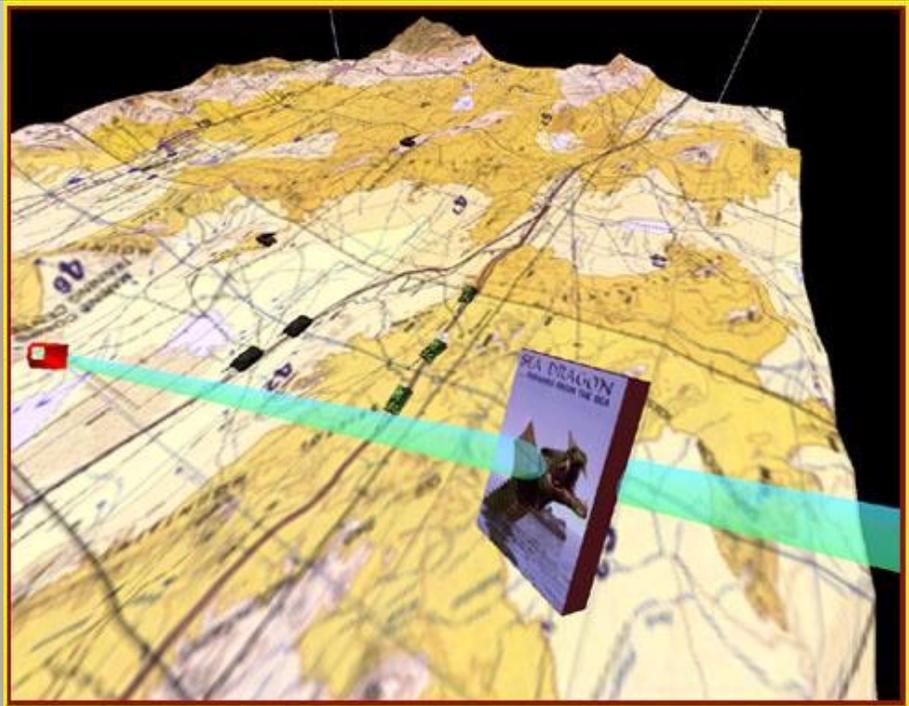


Hunter Warrior



Joint Counter Mine

The Virtual Laser Pointer



- 1) gesture recognition using pinchglove
- 2) speech recognition
- 3) hand-held joystick

virtual laser pointer interaction technique

Navigation Metaphors

map-centric navigation

- **metaphor**: physical map on table surface
- **modes**: pan, zoom, pitch/yaw
- user gesture = **distance** of virtual motion

user-centric navigation

- **metaphor**: airplane flying over map
- **modes**: pan/zoom, pitch/yaw, rotate/zoom
- user gesture = **velocity** of virtual motion

Entity Manipulation



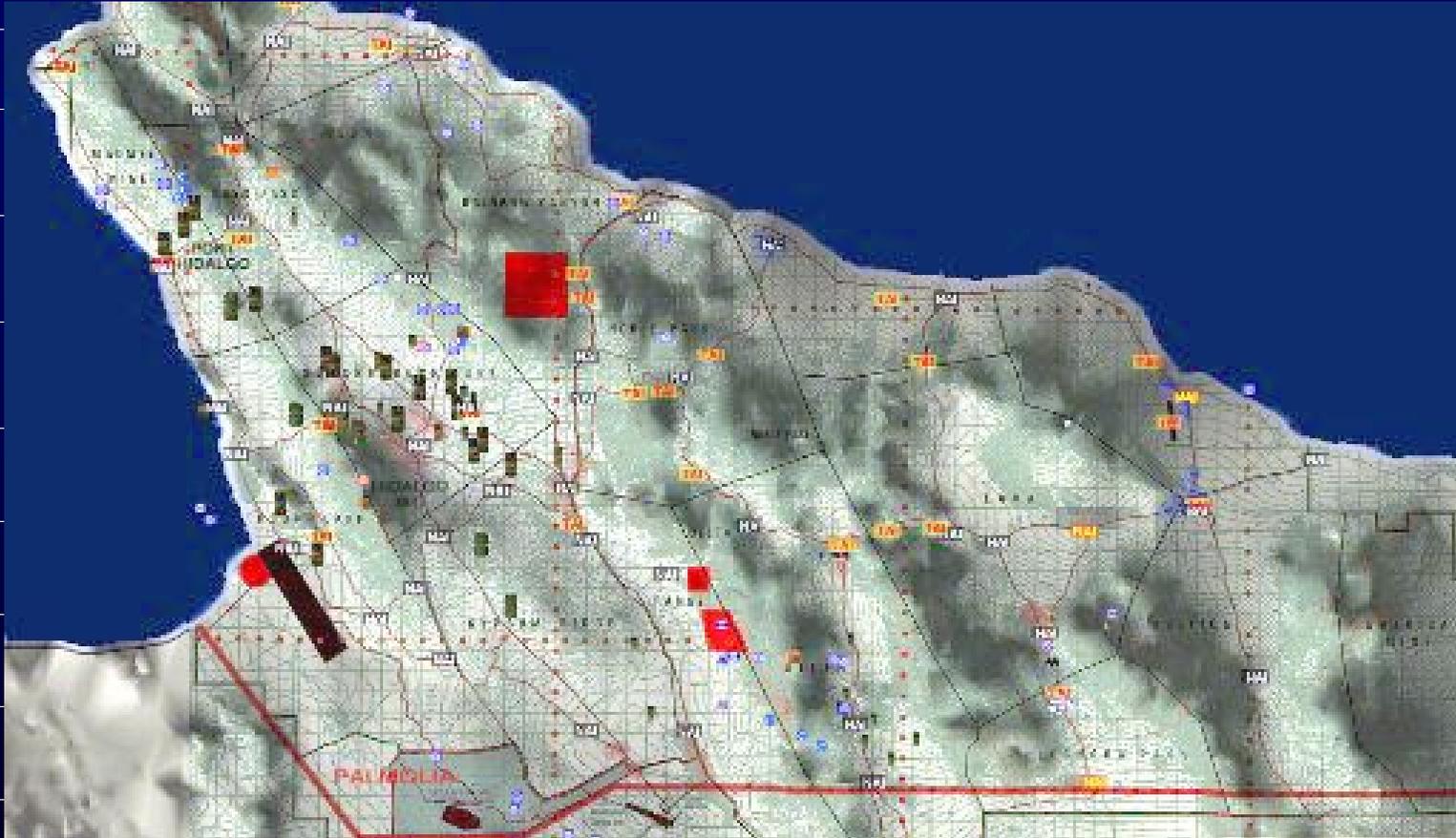
Models and Symbology



- 1) "realistic" models
- 2) standard military symbols

Intelligence Preparation of the Battlefield symbology

Model Scaling and Aggregation



scaling: want entities to be visible at different zoom levels

aggregation:

- sometimes want entities to be distinct
- sometimes want to aggregate into hierarchical units

Conclusions

traditional paper map

- too time-consuming
- information overload

Dragon system

- goal: apply visualization techniques to battlefield visualization
- + 3D battlefield visualization
- + symbolic and realistic entities
- + display results on responsive workbench
- + intuitive interface for navigation and manipulation
- + single, unified presentation device
- + field experience suggests Dragon's utility

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Major Challenges in Battlefield Visualization

what visualization attributes are required to support battlefield visualization tasks?

- discover what the battlefield visualization tasks are
- how to visualize different battlefield components
 - terrain / battlespace
 - discrete objects (tank, ship, ...)
 - dispersed objects (troops, NAI, ...)
 - amorphous phenomena (smoke, weather, uncertainty)
 - aggregation / hierarchies

how do we achieve real-time performance for very large scene databases?

- develop underlying technology to support
 - rendering techniques
 - level-of-detail / hierarchical data structures
 - database techniques