

Quadelta Incorporated

Target Tracking **Visualization Tool**

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Problem Statement

This presentation will address the following issues:

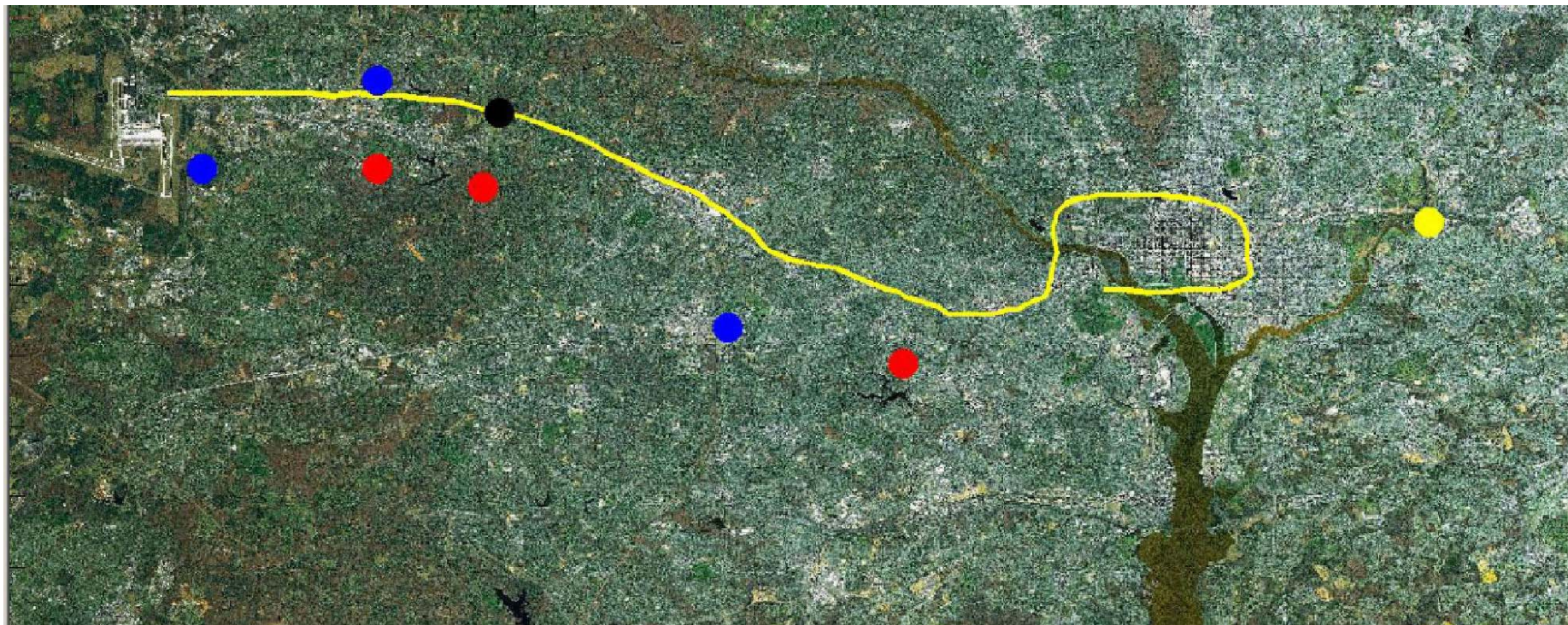
- 2-D Situation Awareness Display
- Vanishing Pixels
- Visualizing Heading During Flight Maneuvers
- Displaying Areas of Disengagement
- Visualizing Camouflaged Targets
- Engaging Targets at Sea
- Visualizing Areas of Vulnerability



All images shown in this presentation were created, rendered, and driven by MathWorks products and nothing else.



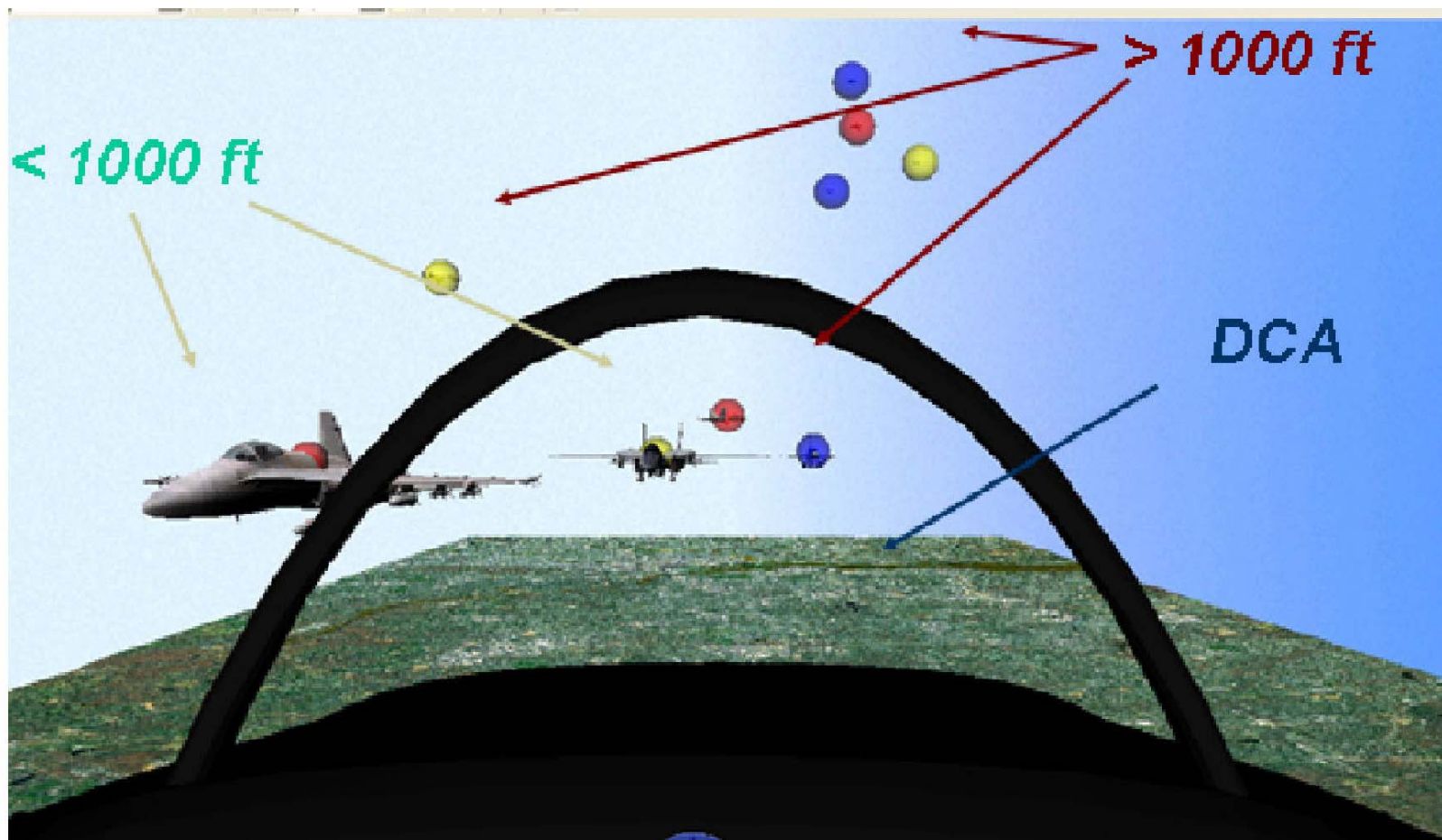
2-D Situation Awareness Display



This mission begins at Dulles IAD and circles DC. Hostiles are in red, friendlylies in blue and yellow is unknown. Ownship is in black and follows yellow flight path.



Vanishing Pixels – 3D Objects, 2D World

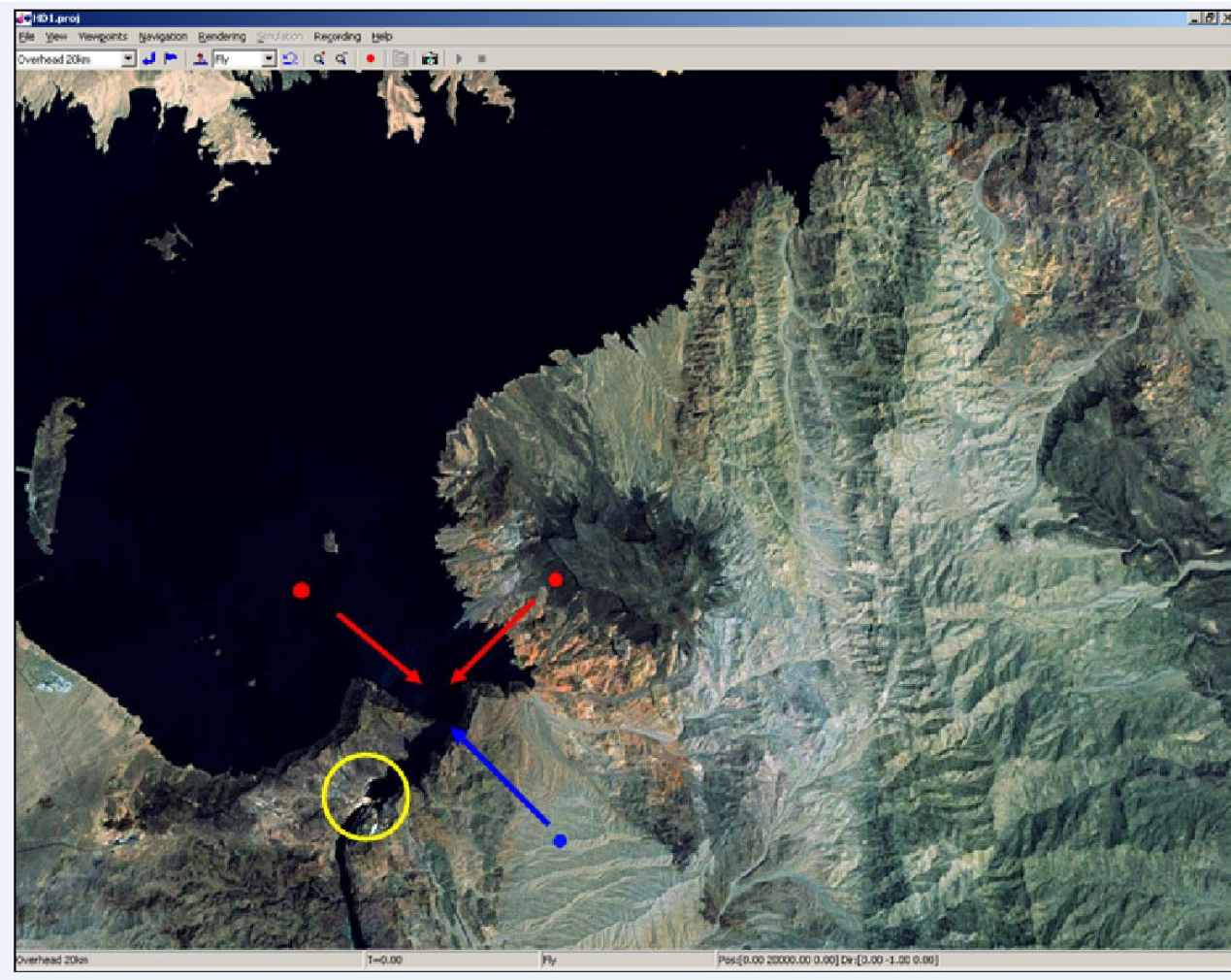


Aircraft models reduce to a single pixel very quickly. Their pixels vanish as distance increases.



Visualize Heading During Flight Maneuvers

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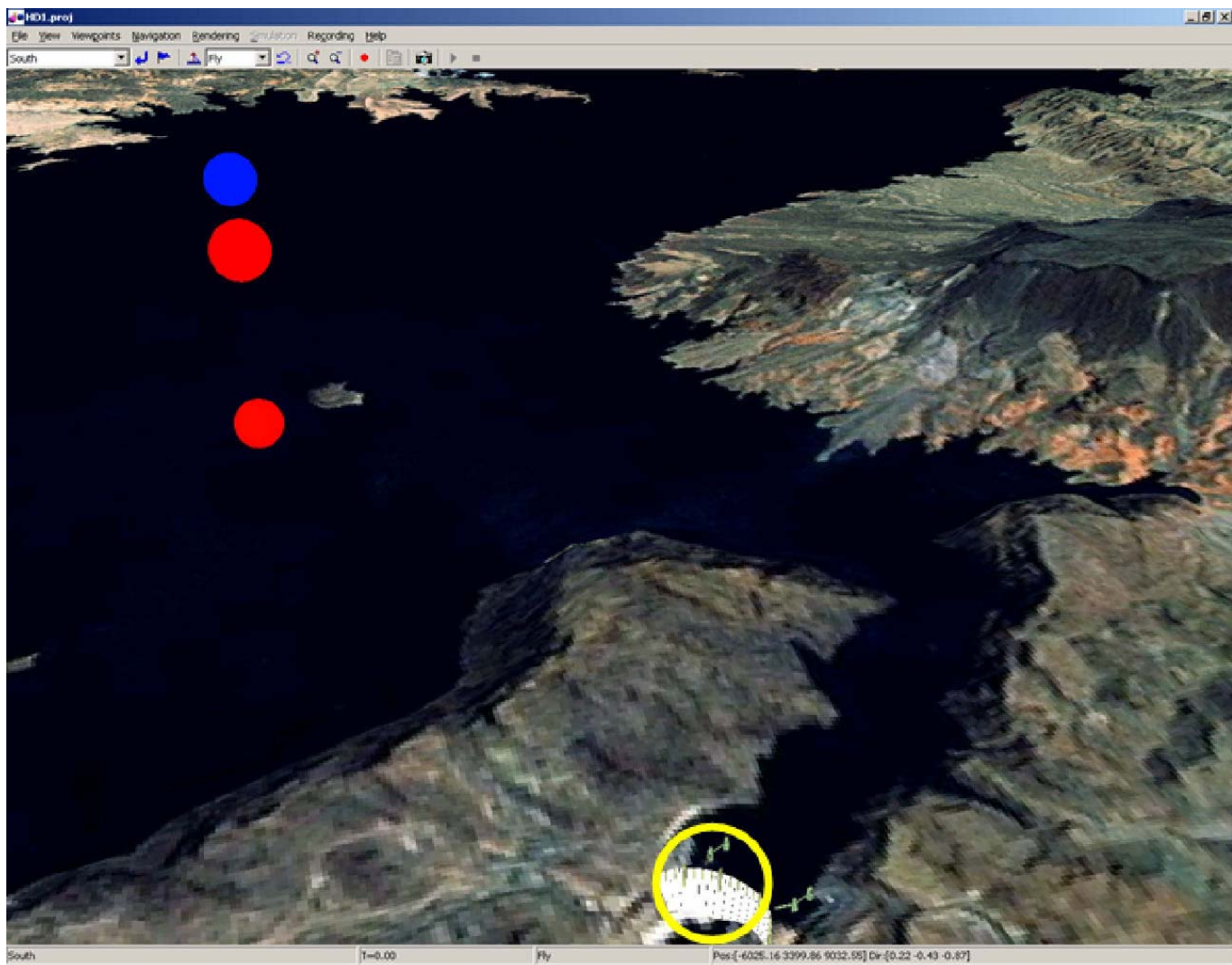
Use Handle Graphics to display “Heading Indicators” in any color as shown here above Hoover Dam.

Areas of importance may be highlighted as well.



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Sphere Size Adjusted to Altitude or Threat Level



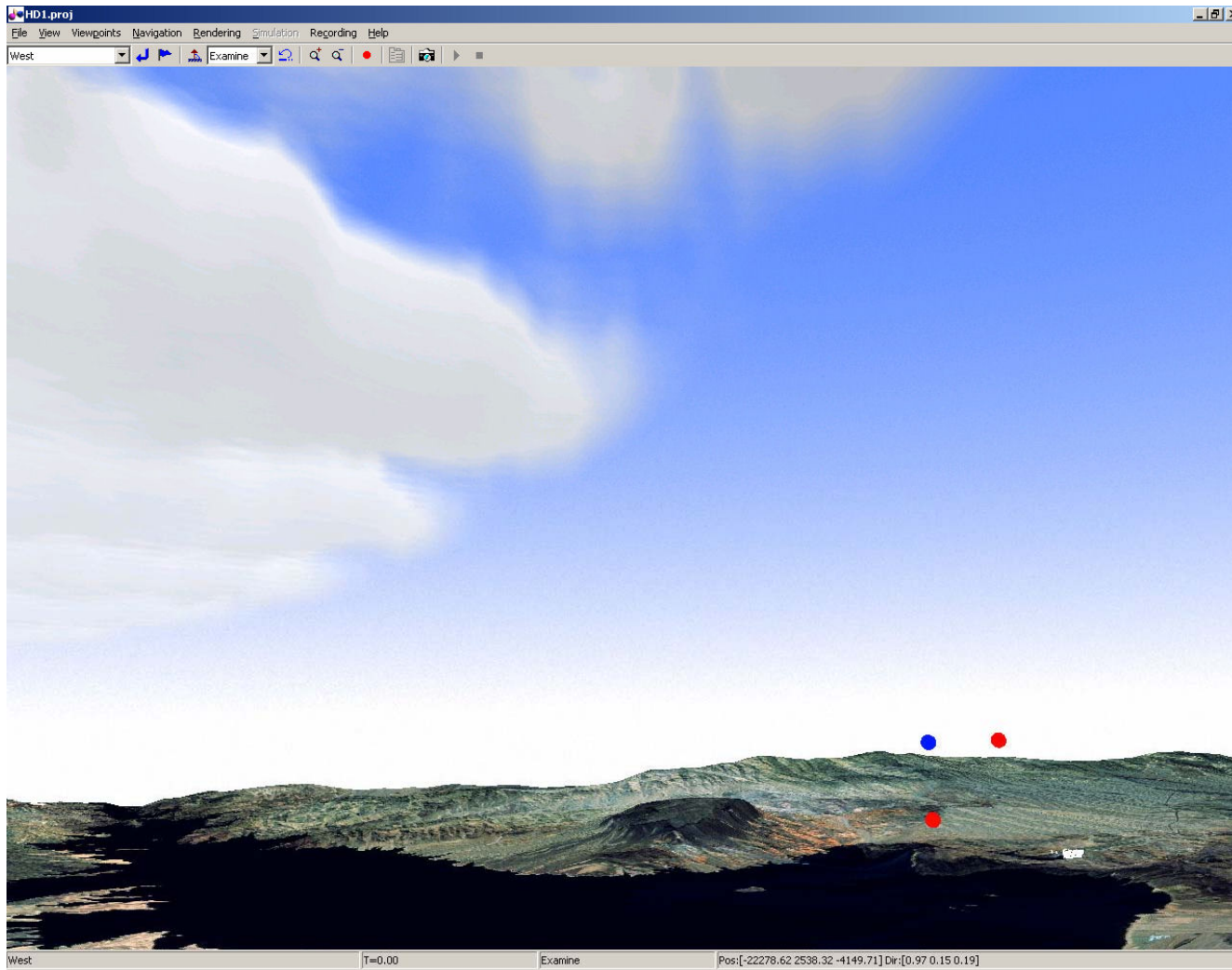
Adjusting the radius of the spheres could be used to indicate altitude or threat level.

Notice how, again, Hoover Dam is highlighted.



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Visualization of Airborne Targets

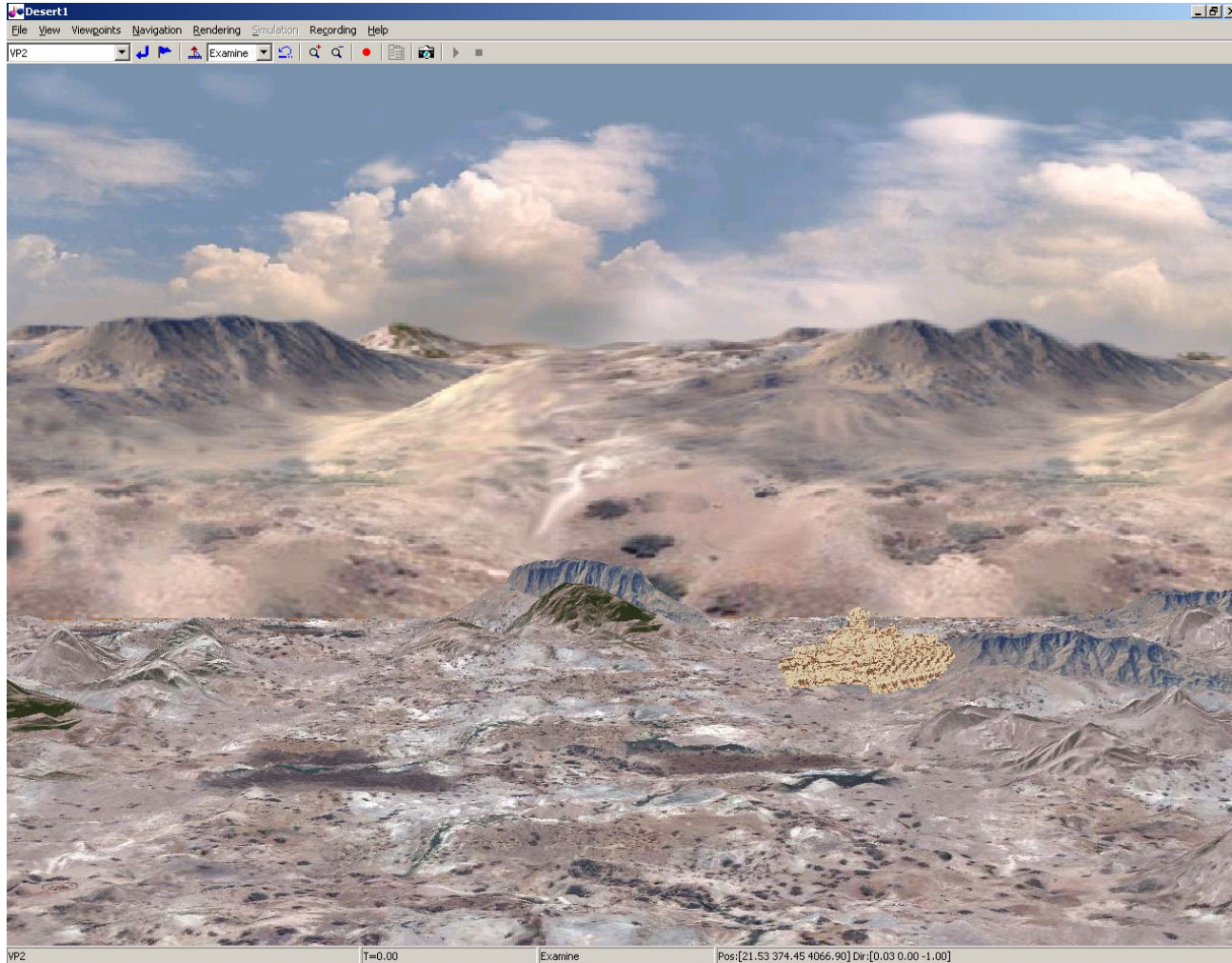


When using fixed cameras, be sure to leave plenty of sky in the scene.

Two Red Team members defending Hoover Dam.



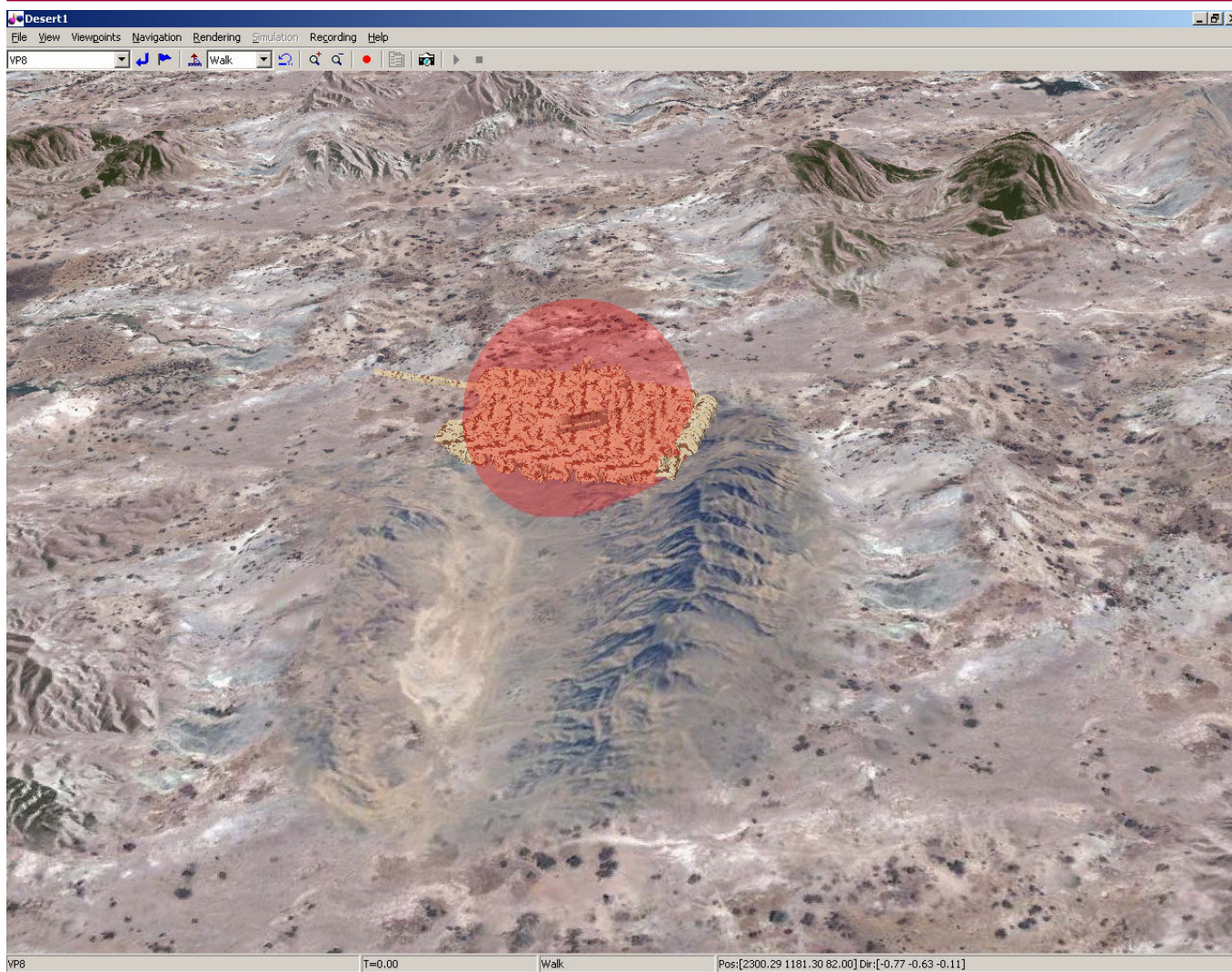
Visualizing Camouflaged Targets



A target (T-72 Tank) painted in desert camouflage may be difficult to visualize in a desert.



Visualizing Camouflaged Targets



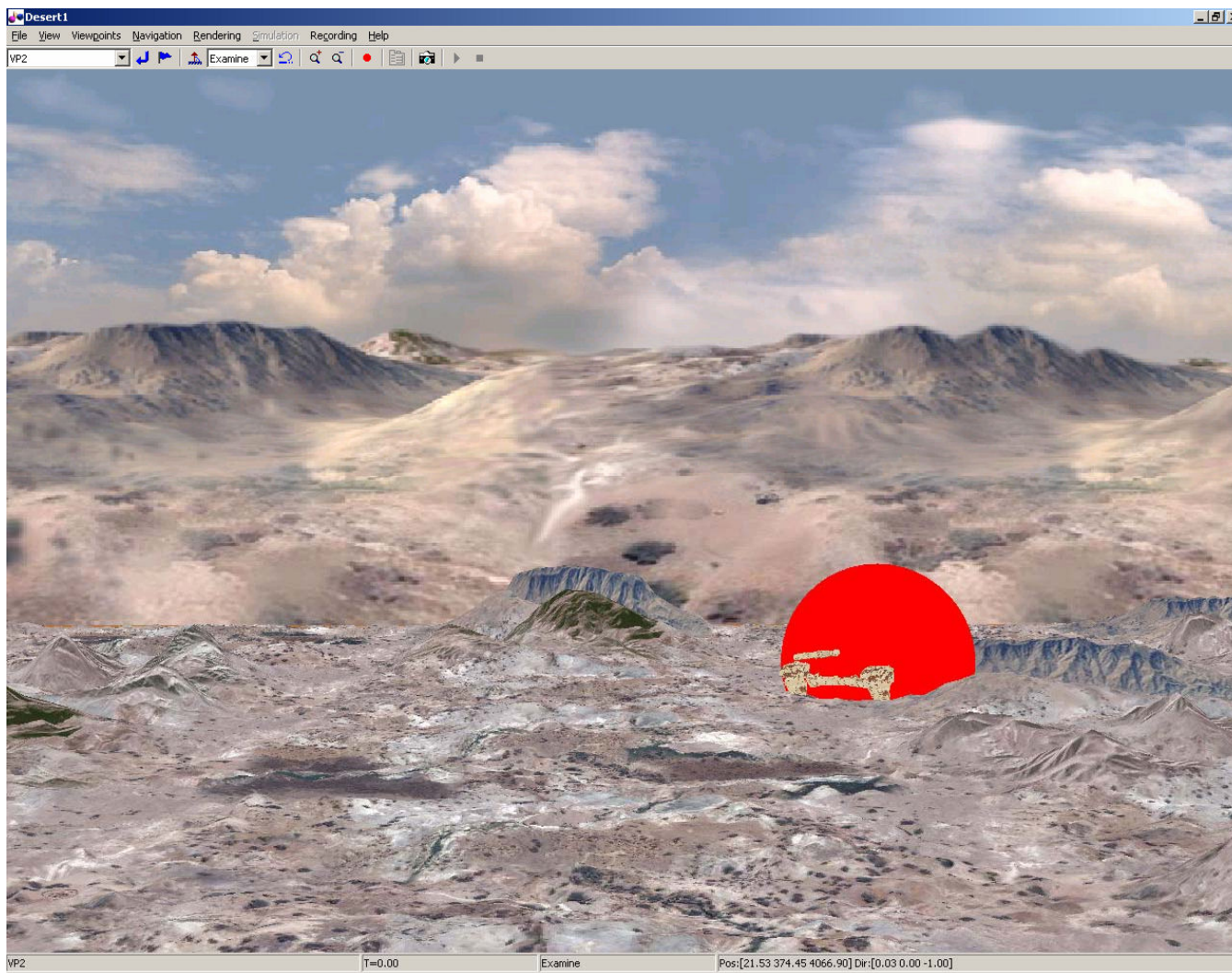
The sensors have identified it as hostile yet it may be difficult to visualize.

Mark the target with a sphere.

The transparency of the sphere can be reduced.



Visualizing Camouflaged Targets



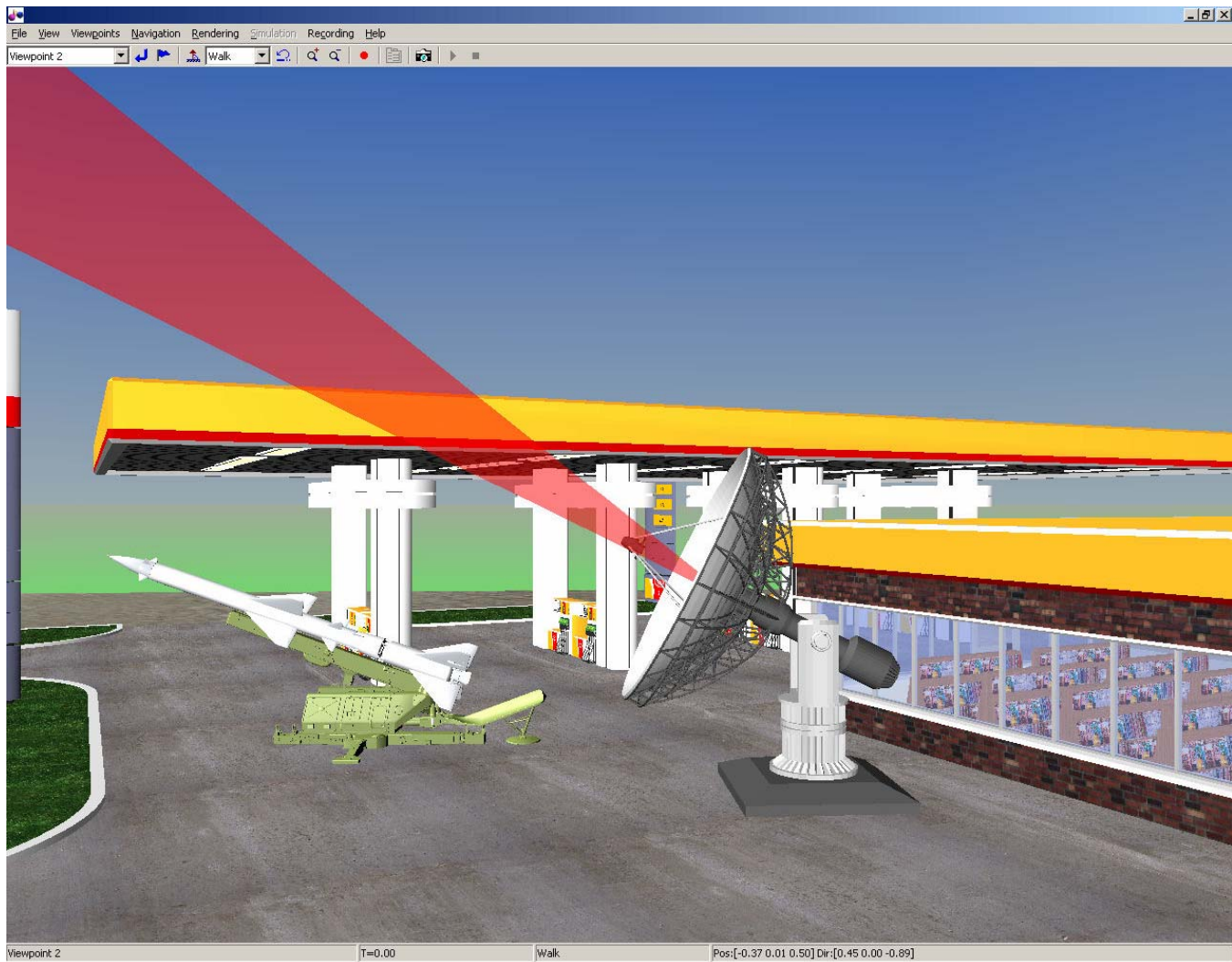
Or, using the Virtual Reality Toolbox, turn the transparency off to create a sphere of certainty as to the target's location, making it very easy to visualize.

Red works well here, but any color may be used.



Visualizing Areas of Disengagement

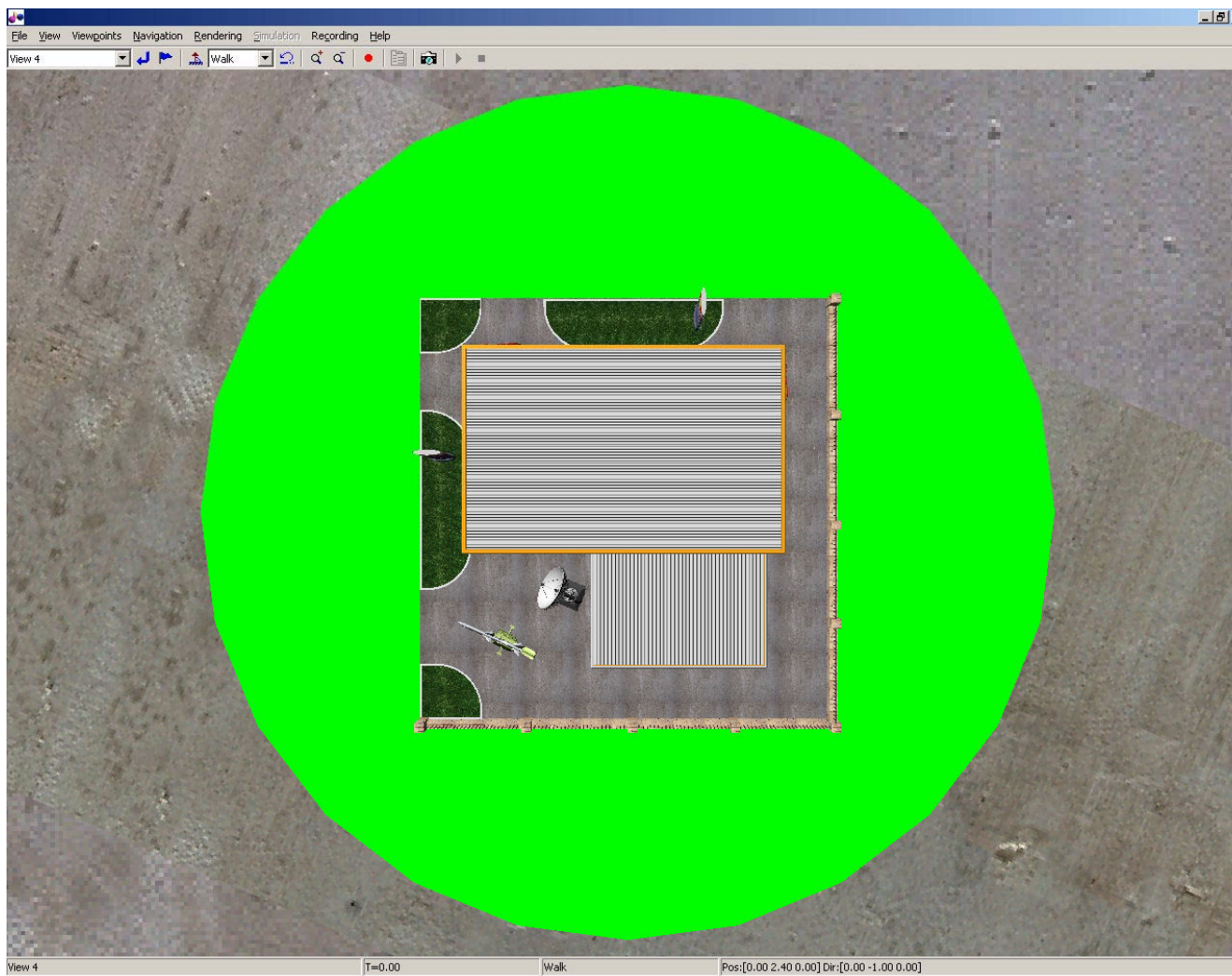
Here “asymmetric threats” are using civilian environments.



Areas of disengagement need to be marked such that they can be identified from aircraft.



Visualizing Areas of Disengagement



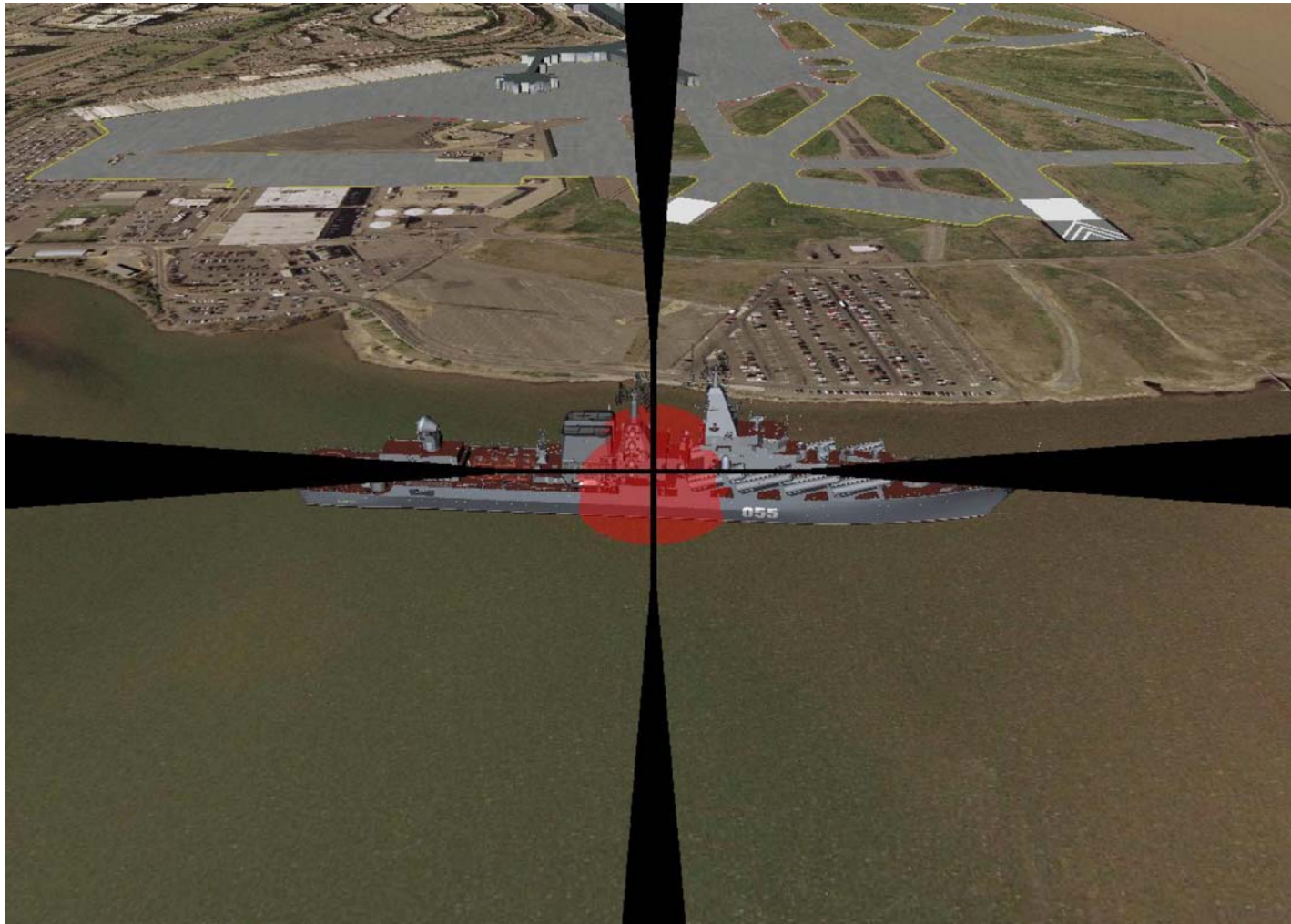
Here the area of disengagement has been marked in green, so that its engagement can be avoided for the time being.

The top view of this Area of Disengagement.



Visualizing the Engagement of Targets at Sea

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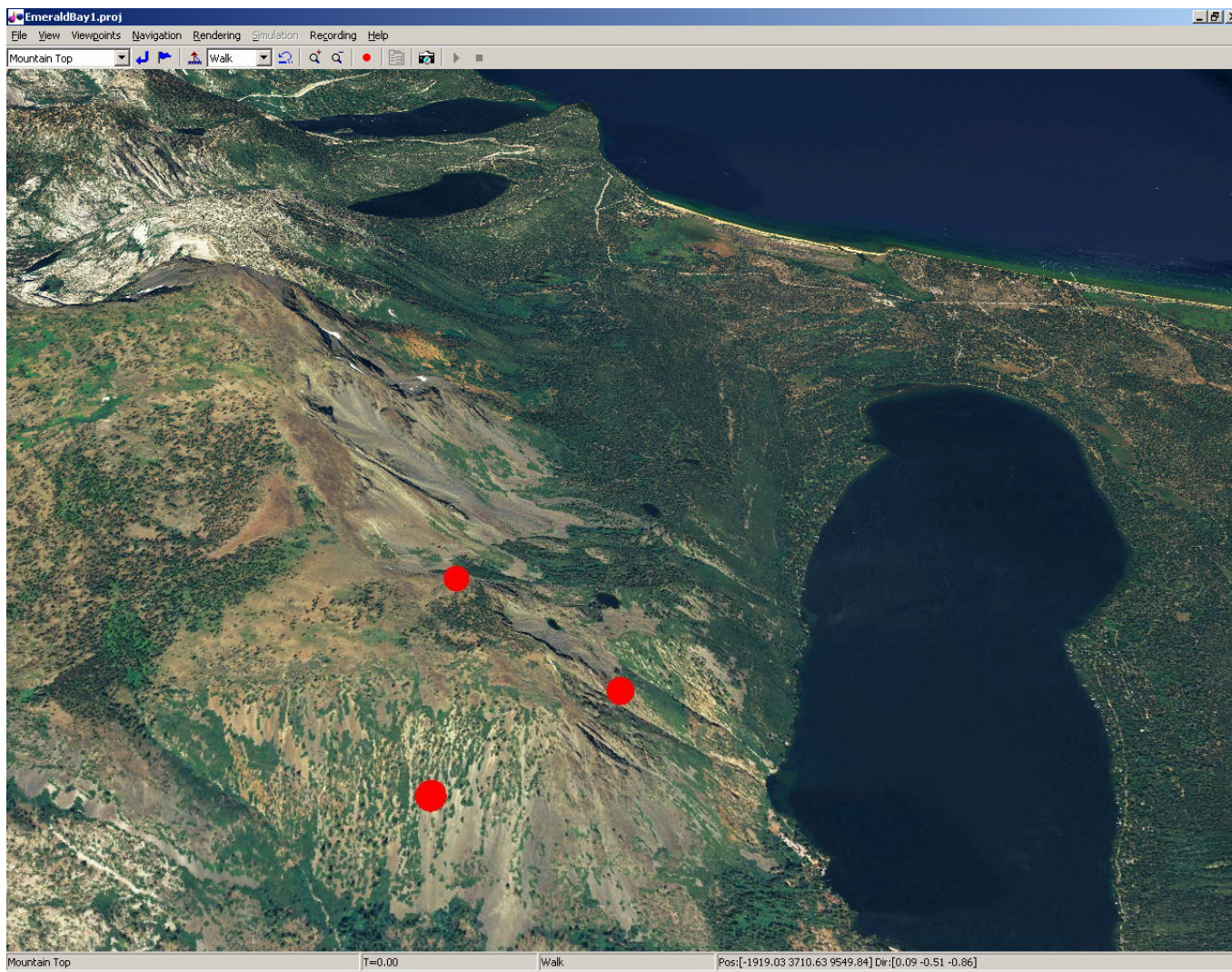


Identified as hostile, cross hairs are displayed and the sphere reduces in size.

A Russian Missile Cruiser just south of Reagan Airport 14



Preparing to Track and Engage the Blue Team



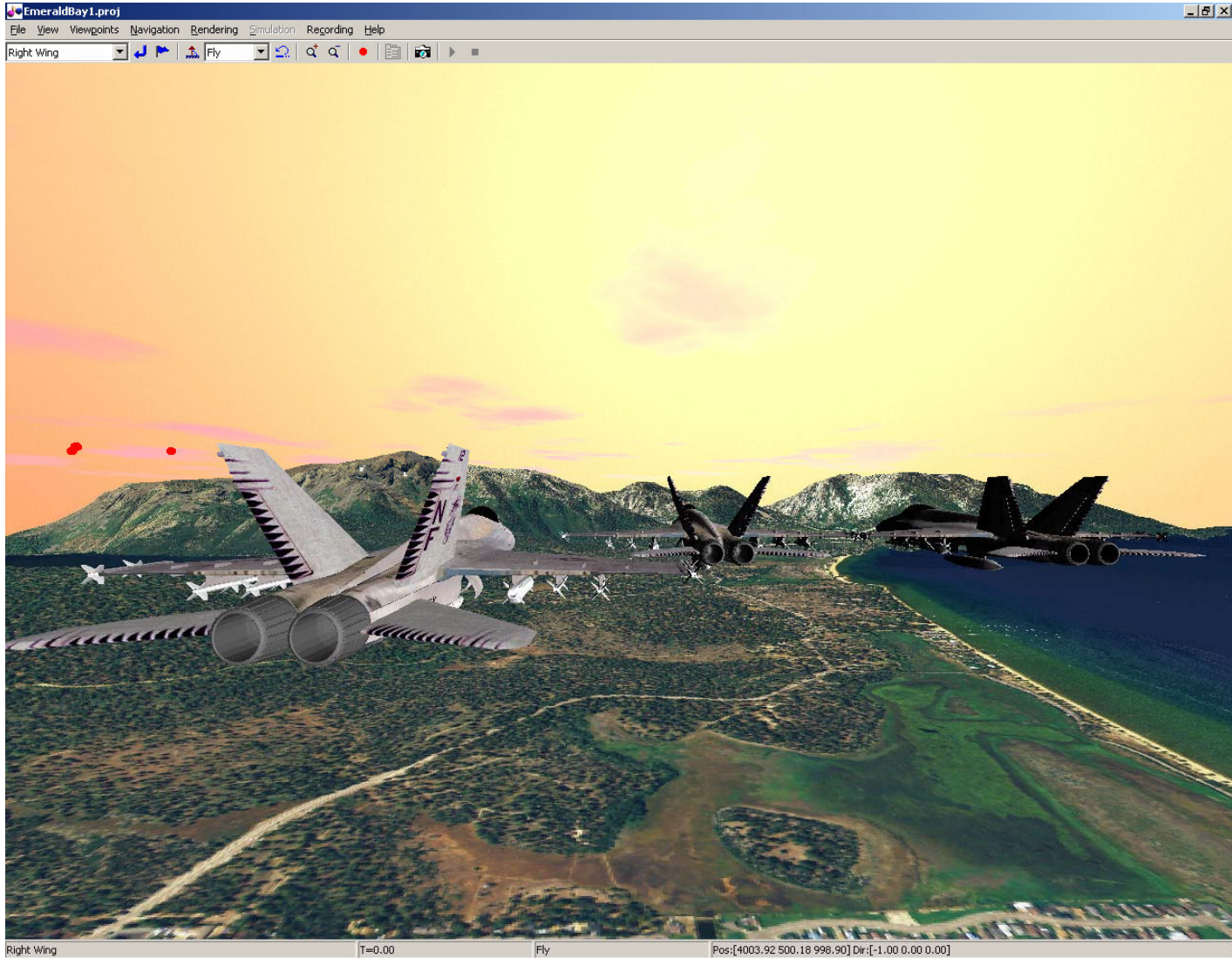
Here the Red Team considers its flight maneuvers over Emerald Lake, CA.

The visualization of targets includes background scenes.



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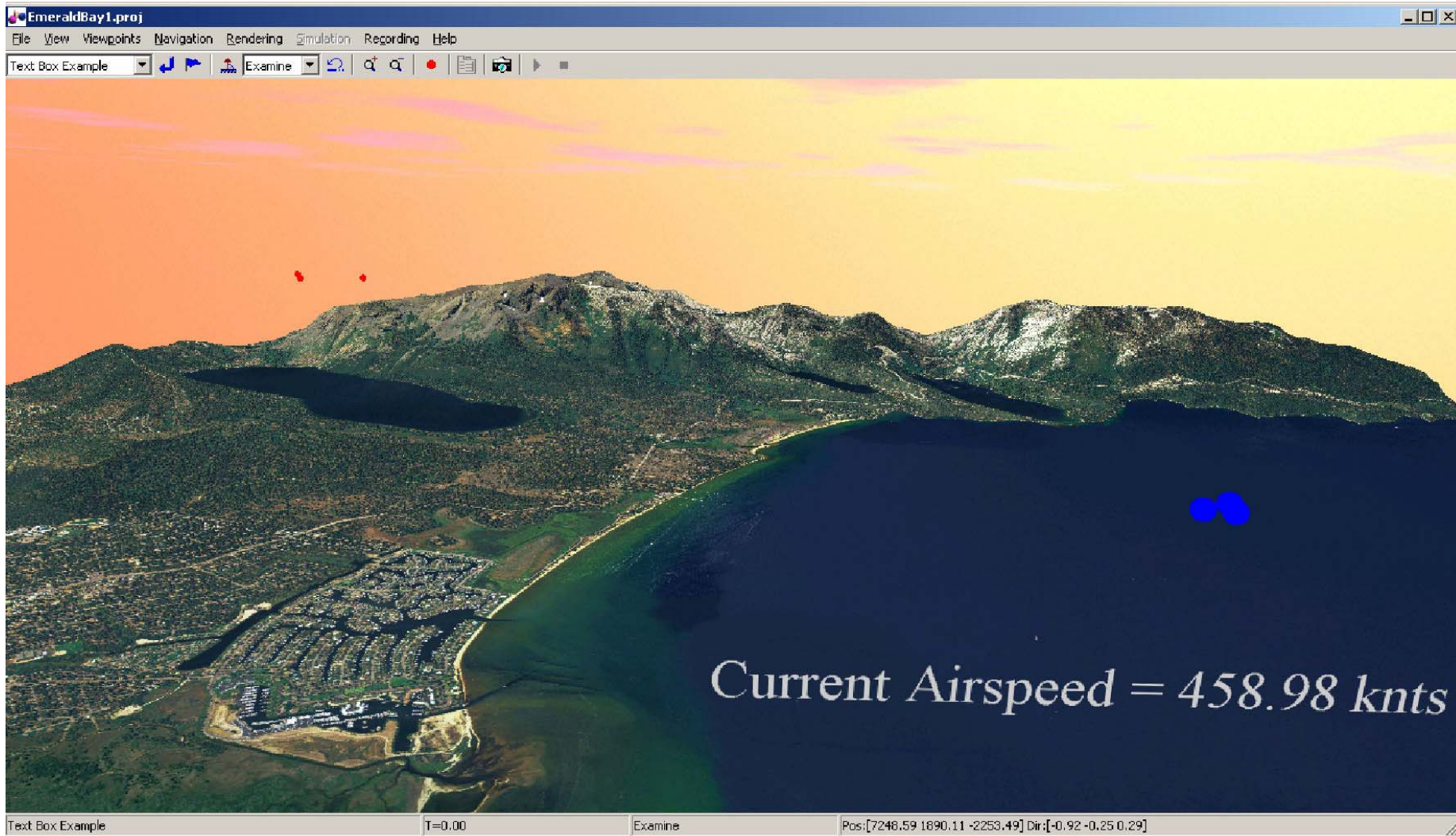
Blue Team Tracking Red Team



Turning the tracking spheres on and off is optional.



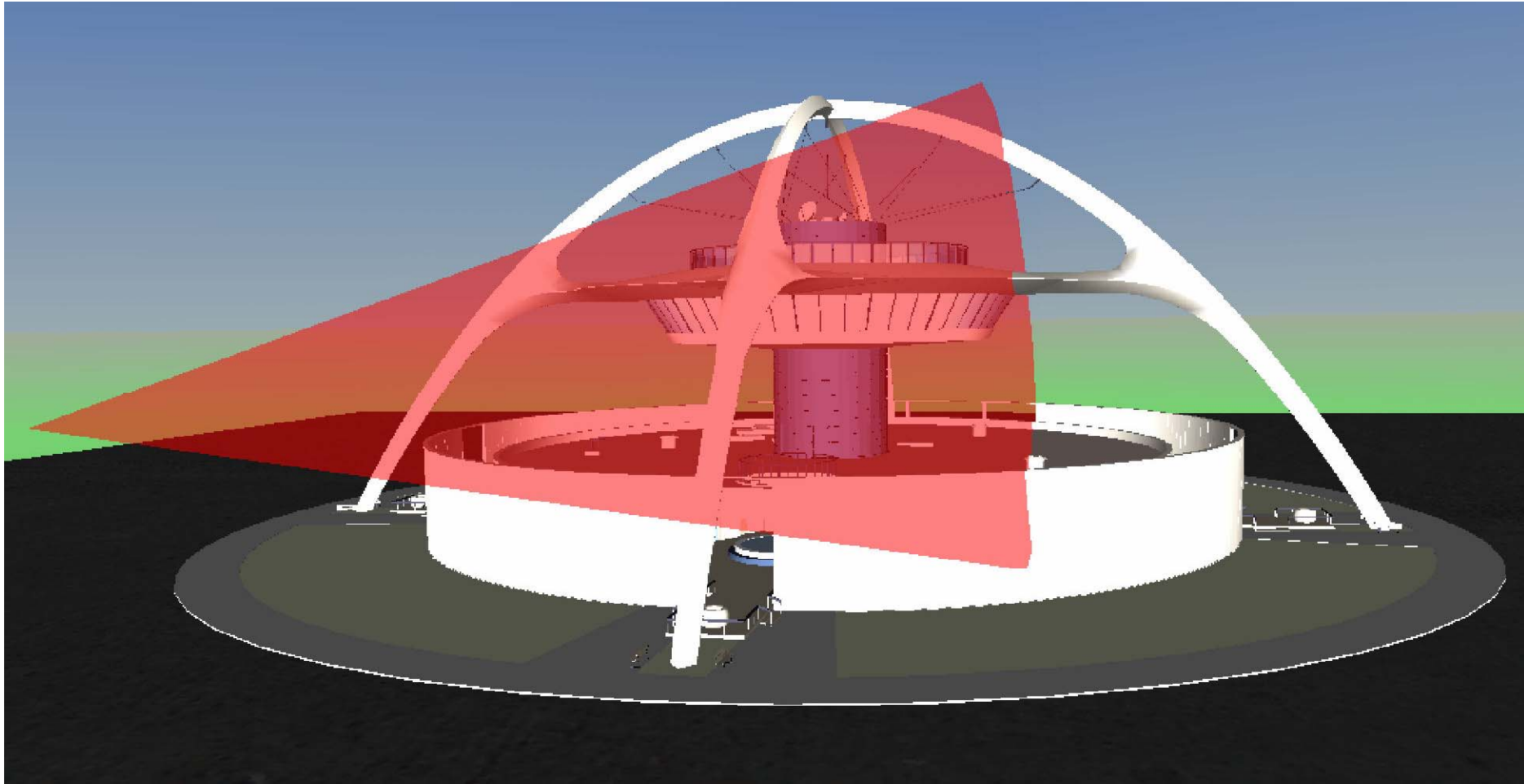
On-The-Fly Text Displays



Can be used as warnings or as current indicators.



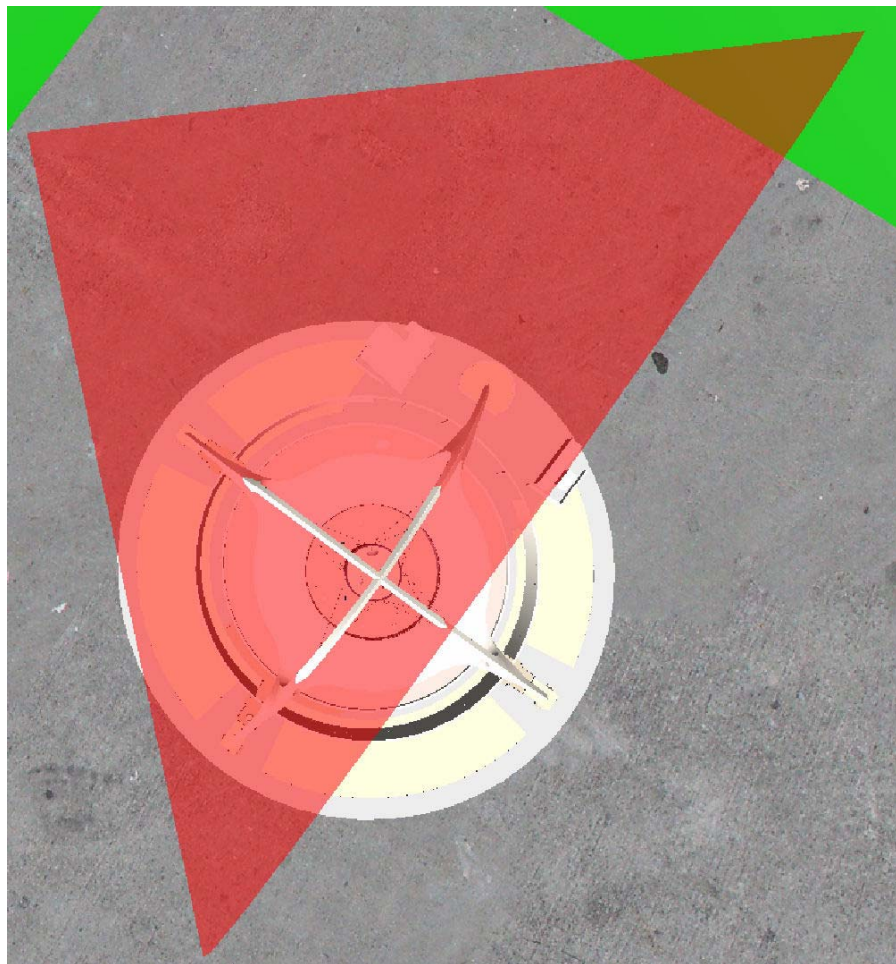
Visualizing Areas of Vulnerability



The LAX Theme Building has been isolated here to display its vulnerabilities from a given point based on azimuth, elevation and range.



Visualizing Areas of Vulnerability



One part of the tracking of targets includes the determination or protection of areas of vulnerability.

Here, the area of vulnerability is displayed based on azimuth from a particular point.

Top view of the LAX Theme Building.



The Summary:

- Target tracking visualization tool that addresses all of the issues in slide 2 has been successfully developed.
- The following MathWorks products were used:
 - MATLAB
 - Image Processing Toolbox
 - Mapping Toolbox
 - MATLAB Compiler
 - Virtual Reality Toolbox
- Benefits:
 - Utilized integrated MathWorks products for algorithm development and data analysis as well as visualization.



Credits and Acknowledgements

- Dr. Kenneth Hintz – George Mason University's Sensor Management System - GMUSMS
- MapMart – www.mapmart.com
- 3D Nature – www.3dnature.com
- MathWorks Tech Support



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