Situational Awareness Using the VR Responsive Workbench

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Our task is to provide situational awareness for the complex logistical task of directing the movement of U.S. Marines and material over rugged terrain, day and night, in uncertain weather conditions. This difficulty is multiplied by the well-known dangers of amphibious assault, long considered the most difficult problem in warfare. Even with the advent of computers and sophisticated decision-making software in Marine Corps Combat Operation Centers, command and control is predominantly undertaken with paper maps and acetate overlays. This is a cumbersome, time consuming process. In addition, detailed maps and overlays can take several hours to print and distribute. There currently exists no overall picture of the battlespace that provides a commander with a dynamic range of resolution sufficient to track units ranging from aircraft carriers to six-Marine fire teams.

NRL has used its VR Responsive Workbench for several applications [1,2], and Figure 1 shows the Workbench used for situational awareness. As part of a Marine exercise in March 1997, we developed map-quality 3D terrain image of the area around Twentynine Palms, California (62 x 72 Km) and inserted a virtual "ocean" outside a road network bordering Twentynine Palms. Using clip-mapping techniques, the terrain was textured with line-drawing maps at a geographic resolution approaching 1:25,000. To create the clip-map texture, the final image was cut into a pyramid of 1Kx1K tiles. Both 3D models and standard IPB icons were used to represent objects to be placed on the terrain. The models and icons were selected and modified through discussions with the Marines. The user chooses between 3D stereo and non-stereo modes for viewing.

NRL has developed three interactive methods for use with the Workbench: gesture recognition using a pinchglove, speech recognition, and a simulated laser pointer ("wand"). The latter was used for this system because of its robustness. The wand provides a convenient and intuitive method for scaling and translating the terrain. When the laser intersects the terrain, it's as if the user's hand were attached. Lateral hand movements pan the image, while vertical movements zoom in and out. Rotations of the image are performed by rotating the wand. There are also modes that use the wand to pick up and move objects, to query objects, to measure distances and headings, and to perform several other tasks. Figure 2 shows the terrain with models and icons; on the Workbench it can be viewed in 3D stereo.

The system is being developed further to support an exercise scheduled for 1999 that requires situational awareness in the much more challenging case of an urban environment. Additional information, figures from the 1997 exercise, and a CNN Headline News segment on the use of the Workbench during that exercise can be found on our homepage: www.ait.nrl.navy.mil/vrlab. A more detailed description of this application, along with a discussion of Workbench technology, will appear in [3].

References

[1] Rosenblum, L., S. Bryson, and S. Feiner, "Virtual reality unbound," *IEEE CG&A*, Vol. 15, No. 5, Sept. 1995, pp. 19-21,

[2] Rosenblum, L. J., J. Durbin, L. Sibert, D. Tate, J. Templeman, U. Obeysekare, J. Agrawaal, D. Fasulo, T. Myers, G. Newton, A. Shalev, “Shipboard VR: from damage control to design”, *IEEE Computer Graphics and Applications*, Vol. 15, No. 6, Nov. 1996.

[3] L.J. Rosenblum, J. Durbin, and R. Doyle, “The Virtual Workbench: Applications and Experiences,” to appear in *Virtual Reality on the WWW and Internet*, Computer Society Press.