OBSTACLE MARKING AND VEHICLE GUIDANCE SCIENCE AND TECHNOLOGY OBJECTIVE (OMVG-STO)
AUGMENTED REALITY FOR ENHANCED COMMAND AND CONTROL AND MOBILITY

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1. THE CHALLENGE

Advances in technology, improved communications and rapidly changing conditions create an operational environment in which decisions must be made quickly and momentum, once achieved, must be sustained. The increase in Joint and Combined operations has increased the need for real-time coordination among diverse units. This demanding environment requires new display paradigms that facilitate rapid decision making, movement and command and control.

2. PROGRAM OVERVIEW

The OMVG-STO effort is creating a low-cost technology to enhance situational awareness by integrating the current tactical picture into real-world views in real time. The system provides additional, intuitive displays to support precision navigation around obstacles and through restricted terrain. The OMVG-STO system is equipped with a capability to realistically inject simulated enemy forces into real-world views to support mission rehearsal and gunnery training applications. Once fully developed, the technology will be transitioned to the Objective Force for integration into a variety of U.S. Army systems.

3. TECHNOLOGY DESCRIPTION

The OMVG-STO system uses a unique implementation of the Augmented/Enhanced Reality technology to produce real-time “combined views”.
The demonstrator system uses a Kalman filter suite to obtain real-time vehicle position and orientation from data provided by a group of COTS instruments. This position and orientation information is used to align representations of the real world with a computer-generated virtual world, which contains a 3-D graphic representation of current command and control information. An imaging software/hardware component uses a variety of masking and rendering routines to integrate the two pictures into the combined views shown in the figures.

The current OMVG-STO system supports the generation of these real-time combined displays from static and moving platforms. The current strap-on demonstrator system has been used to support smooth combined image generation on static vehicles as well as vehicles moving at speeds in excess of 60 mph. We have demonstrated an absolute fixed positional accuracy of +/- 3 to 5 meters coupled with a relative positional accuracy of +/- 2 centimeters.

4. TECHNOLOGY APPLICATIONS

The four figures in this article represent views that can be achieved using current demonstrator systems. In Figure 1 route markers are integrated into the real world view from a moving vehicle. As the vehicle moves, cones pass overhead, marking the route to be followed. Phase lines, objectives, signs, rally points and other graphics can be similarly integrated into the scene. Such a display can be used to mark out mission supply routes or contingency routes.

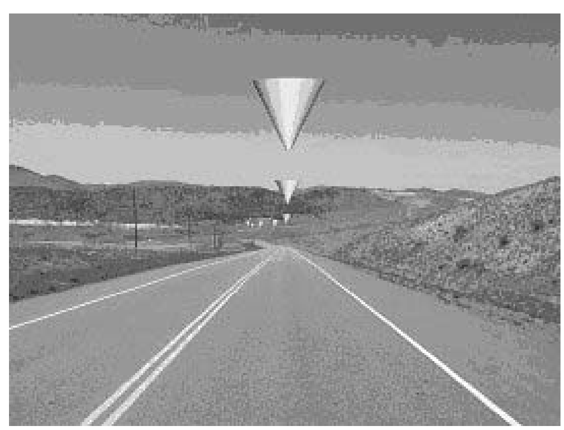

Figure 1: Virtual route markers generated in real-time

In Figure 2 virtual markers are used to identify a cleared lane through a minefield. While we do not envision that the Objective Force will frequently construct breeches, this same technique can be used to facilitate obstacle avoidance. Precision, on-board, vehicle navigation facilitates movement through severely restricted areas, should the tactical situation mandate such maneuvers.

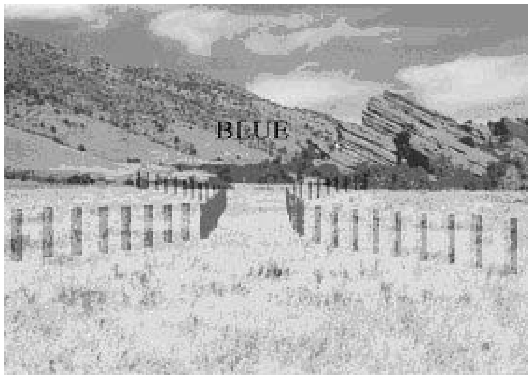

Figure 2: Virtual lane markers in real world

In Figure 2, the marking of the minefield breech can augment actual physical markers. If the physical markers are destroyed, the ability to navigate the breech is still retained. The marking of routes and obstacles using this technology will work in all environmental conditions to include night and limited visibility situations.

In Figure 3, a virtual target is injected into a Mark 38 gunner's real world view, using a strap-on gunnery training demonstrator. This system allows Navy personnel to engage virtual targets in a live fire or dry fire mode with the Mark 38 machine gun, while at sea. This use of the technology is being pursued in our Virtual Target Gunnery System (VTAGS) program.

Figure 3: Virtual targets support training at sea

In Figure 4 a T-80 tank is injected into the real-world view to support activities such as mission rehearsal, reconnaissance training and vehicle identification. The OMVG-STO technology can greatly improve upon the realism of current field training by injecting a realistic virtual force into the exercise.

Figure 4: Virtual target integrated into real world, real-time scene

5. ANTICIPATED BENEFITS & CONCLUSION

The OMVG-STO enhanced reality technology is a promising method that can help the Objective Force reduce decision cycle times by integrating command and control information into real-world views. It can eliminate the time currently required to correlate separate displays with "out-of the window" views. The technology can increase overall lethality, by aiding in coordinated strikes and other cooperative activities among disparate units. The technology described here can be used to support a more agile force by increasing the realism and frequency of training. The application of this technology can lead to the ability to realistic rehearse future operations on short notice on actual terrain in actual combat vehicles. Finally, the technology can be used to increase force survivability by providing precision navigation when maneuver through constricted areas or during periods of low visibility are required.

6. ACKNOWLEDGMENTS

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Pathfinder Systems' technology for the insertion of virtual entities into real world, real time views is covered under US Patent 6,166,744

Use of the technology in US Government programs is covered under license agreement number STRICOM-02-L-0001.