Three-Dimensional Head-Up Weapons and Navigational Displays For Airplanes, Helicopters, Tanks, Ships, and Submarines

by Stanley H. Kremen

On an airplane, a pilot's visual field is very limited. On most airplanes, pilots mostly see straight ahead with some peripheral vision. They can also look down, when what they observe is far away. They cannot see above them, below them, or behind them.

Head-Up Display For Fighter Aircraft

The photograph above shows a typical view for a pilot of a fixed-wing fighter aircraft. An electronic head-up display is shown, which provides data for the pilot to perform various functions.

Commercial helicopter pilots have a much broader view in front, above, and below. This is because of the shape of the helicopter window. US military helicopter pilots do not enjoy this advantage. While broader than fixed wing planes a helicopter pilot has a limited visual range.

A Commercial Helicopter

A US Military Helicopter

Tank drivers have an even more difficult time seeing what is around them. A tank is an enclosed

armored vehicle in which a driver can only look straight ahead.

It is almost as if a driver of a tank must look through an oversized peephole to see where he is going. This is done to protect the crew inside of the vehicle. Windows would make the tank more vulnerable. This is why when a tank is not under threat from enemy attack, one crewmember will stand up with his head outside the vehicle and provide verbal instructions to the driver regarding the tank's surroundings.

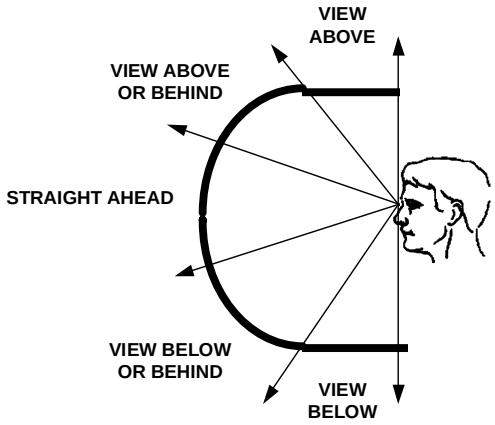
The visibility problem experienced by tanks as armored vehicles is greatly magnified with submarines. The armor of a submarine must not only protect the vehicle from enemy attack, but it must also protect it from extremely high water pressure. Having a transparent window on the bridge or anywhere on a submarine that would make the surroundings visible would compromise the integrity of the vehicle's structure. Transparent windows are only available on small submersible vehicles. However, these vehicles cannot go very deep. The captain of a submarine can only peer outside a submerged submarine visually using a periscope (another peephole). And, this can only be done when the submarine is very close to the surface. In order for a submarine captain to sense the ship's environment, sonar must be used. The sub's sonar equipment sends out a "ping," and measures the time for the sound to return. In this way, the distance to various obstacles is known. However, this method of sensing the undersea environment is incomplete and very inaccurate.

View From the Bridge of an Aircraft Carrier

A large ship (surface vessel) has a somewhat different problem. The control room, or bridge, is located at the highest point on the ship. A bridge is not compromised by having windows. In fact, some bridges have panoramic windows that allow bridge personnel to see in many different directions. However, from the bridge, one cannot see what is directly ahead, directly alongside, directly behind, or directly above or below the vehicle. For this purpose, seamen must look over the side of the ship. But, for a large ship, this would involve many people doing this to obtain a complete picture. Fortunately, most times, the

sea is so vast that very little occurs in the immediate vicinity of a ship.

It would be extremely beneficial if a three-dimensional display were to be available that would visually represent the surrounding environment of airplanes, helicopters, tanks, submarines, and ships. This would add new navigation and weapons capabilities to these vehicles.



Concept of the Quantum Optics Holophoto™ Three-Dimensional Head-Up Display

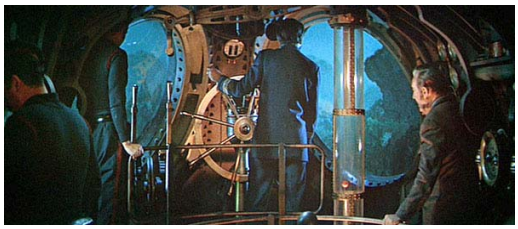
The drawing above illustrates the concept of a three-dimensional head-up display. The Quantum Optics Holophoto™ Three-Dimensional Process employs a multiplicity of fixed closely spaced digital video cameras having small aperture lenses mounted on the outside of the vehicle. The multiple views from these cameras provide the information necessary to create a three-dimensional display. The digital information from these cameras is transmitted to a parallel computer system which processes the images. These processed images are then transmitted to an active special video screen that sends light waves into the eyes of an operator telling him that he is looking directly at the scene outside through a window. All digital transmission is accomplished using dedicated fiber optic cable. The cameras may be made capable of viewing visible light, infrared radiation, ultra-violet radiation, heat signatures, sound waves, *etc.*

The three-dimensional head-up display can surround the operator, or it can take any configuration inside the vehicle. In the drawing, the display surrounds the operator in front and on the sides. The operator may use peripheral vision to detect objects that are outside his normal field of view looking straight ahead. He may then turn his head to see what surrounds him. In the drawing, there are five separate displays shown. The operator may look straight ahead to see what is in front of him. He can look above and below. However, he may change any one of these displays to allow him to look behind the vehicle. This would be a three-dimensional rear view mirror. Once again, the displays do not need to surround the operator. They may be positioned anywhere in the vehicle that is convenient for the operator.

A Quantum Optics Holophoto™ Three-Dimensional windshield and rear view mirror as well as side windows may replace these transparent counterparts in an automobile, and the interior of the automobile could become completely enclosed. It is illegal in all states to have such an automobile, because police must have a way of looking

into the vehicle. However, an airplane, a helicopter, or a tank may have this type of display. Such a display would enhance both the navigational and weapons capabilities of these vehicles.

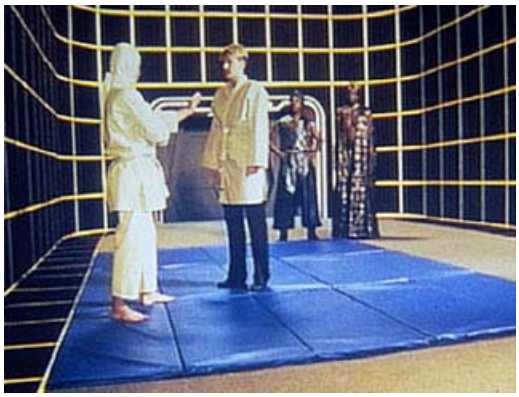
A ship could employ this technology to have a panoramic display of the water's surface that completely surrounds the ship. A submarine could have a picture window display showing what is outside.



Exterior and Interior Views of the Submarine Nautilus From the Motion Picture, "20,000 Leagues Under the Sea"

Such a display was suggested by Jules Verne in 1870 and shown in the 1954 Walt Disney movie, "20,000 Leagues Under the Sea." This is science fiction. So far, it has been impossible to implement.

A screen for the Quantum Optics Holophoto™ 3-D display can be any size or shape. For example, in an enclosed room with four walls, a Holophoto™ screen may be placed on all four walls, the ceiling, and the floor. In this way, the room becomes a three-dimensional immersive environment. This would be the closest thing to the science fiction *HOLODECK* from "Star Trek, The Next Generation."



With this concept, a person situated within such a room would believe himself to be surrounded by water, and protected by a transparent enclosure. When a submarine is submerged in deep water, there is very little light. Rather than being in the azure colored water shown in movies, the scene would be black as night. However, computer software can provide visibility to the display.

All things discussed in this article are possible and can be implemented using technology that is available today. With the patented Quantum Optics Holophoto™ Three-Dimensional Process, it is possible to revolutionize cockpit, vehicle, and bridge display technology to provide improved navigation and weapons capabilities.