DATE: November 9, 2000

FROM: Ronald D. Kriz

TO: A. Habayeb

CC: John Kelso and Fernando das Neves

SUBJECT: NAVCIITI Quarterly Report

RE: - Project 2.0 Visualization HCI and Collaboration
- Task 2.1: Command and Control Visualization
SOW 2.1.1: Identify working simulation models used by NUWC, June 00
SOW 2.1.2: Design CAVE displays to interpret NUWC acoustic model results December 00

Background: Our objective is to provide a distributed collaborative network of graphical and device independent tools in a shared virtual environment which can be used by Command and Control (C&C) personnel to gain a strategic advantage. Specifically we focus on the mission critical C&C interpretation of acoustic undersea data from towed arrays for the Naval Undersea Weapons Center (NUWC) using the CONRAY simulation models. These simulation models can be extended to "real-time" data acquisition systems. Under the direction of personnel from NUWC and the Naval Research Laboratory (NRL) we have identified a working prototype which we have successfully incorporated into our Device Independent Virtual Environment Reconfigurable-Scalable-Extensible (DIVERSE) tool that works in stereo in the (C)AVE Automated Virtual Environment (CAVE), Immersive Work Bench (IWB), Immersive Desk (I-Desk), desktop workstation simulator, and Head Mounted Display (HMD) systems at the Virginia Tech Center for Virtual Environments and Visualization (CVEV), hence the idea of "DIVE" (Device Independent Virtual Environment). The DIVE in DIVERSE provides the basis for collaborative C&C.

Discoveries, Accomplishments, Test Results: Our team has taken the existing CONRAY simulation model from NUWC and put it in stereo on the IWB using DIVERSE as requested. It has not been determined at this point if DIVERSE will be the graphical interface used in the prototype. DIVERSE was used to demonstrate and evaluate the NUWC-CONRAY model in a stereo immersive environment. As a result of this current accomplishment the CONRAY model has been upgraded from Performer 1.3 to Performer 2.3 which allows for extensibility for future development. A snapshot of the DIVERSE Simulator running in the CONRAY model is shown in Figure 1 which shows the C&C observer below the ocean surface and immersed in the ocean terrain overlooking a target. From the observers point of view the DIVERSE Simulator can incorporate a CTISS interface as shown in Figure 2. The DIVERSE Simulator can also incorporate the collaborative awareness tools (2D-, 3D-radars, participant lists, teleportation, etc.) from the CAVE Collaborative Console (CCC) so that these or other collaborative graphical tools or devices can be included as relevant C&C features.

Activities during quarter: On August 15, 2000 R.D. Kriz visited NUWC at Newport, Rhode Island where the CONRAY simulation was demonstrated on a small IWB followed by discussion on how NUWC wanted to proceed. NUWC decided that they wanted to see the CONRAY simulation working in stereo on an IWB at Virginia Tech on November 13 and 14, 2000. We have successfully accomplished this task and the results of this meeting will be posted on the next NAVCIITI report to ONR.

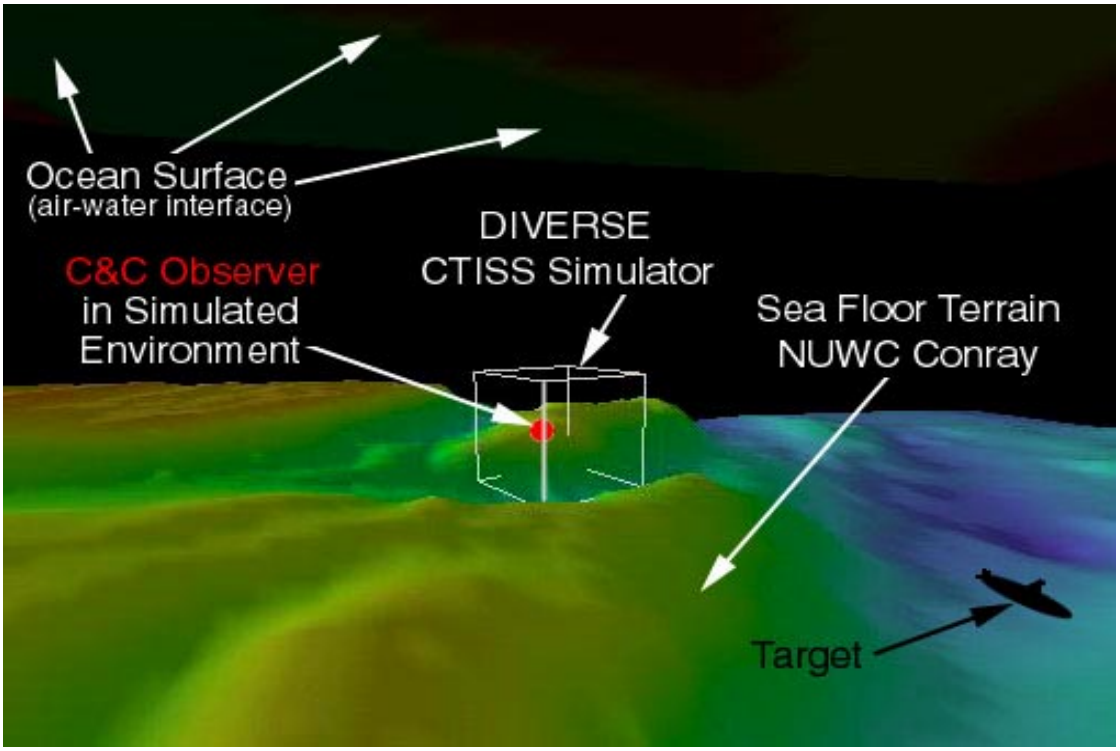

Figure 1. Snapshot of the CONRAY Simulator running with DIVERSE (stereo is not shown)

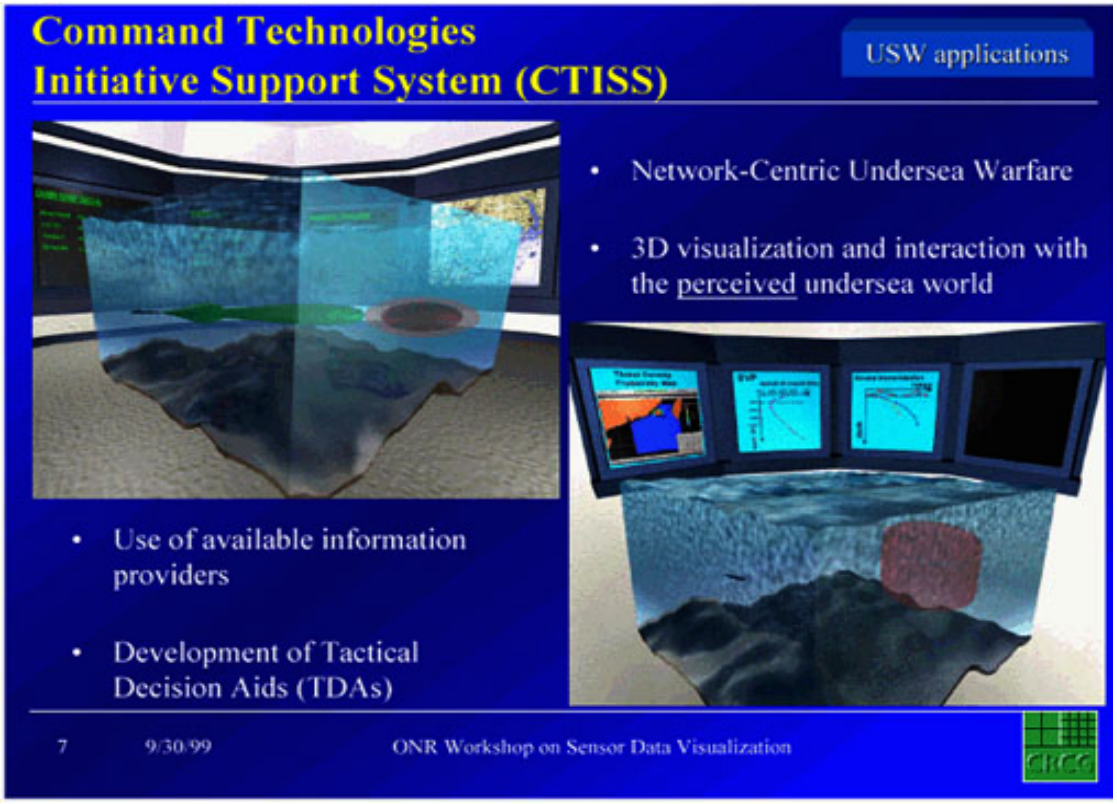

Figure 2. Command Technologies Initiative Support System (CTISS), Reference,"ONR Workshop on Sensor Data Visualization", September 30, 1999.

Plans for Next Quarter: Now that we have a very basic working prototype we will proceed with instructions from Dr. Larry Rosenblum at NRL and NUWC personnel on how and what to incorporate into this prototype to enhance this prototype for C&C. There will be a visit of key personnel from NRL and NUWC to observe this prototype on November 13 and 14, 2000. From this visit and discussions following we will proceed with decisions from NRL and NUWC. Our next SOW due April 2001 will be to demonstrate these displays in the working prototype.

Outstanding Issues: We anticipate that the results of the meeting with NUWC and NRL on November 13 and 14, 2000 will require decisions from NRL and NUWC before we proceed along any particular direction with this basic C&C prototype. We request that NRL and NUWC provide:

- Task Analysis: Concrete definition of the task C&C personnel will perform in context of use.

- User Interface: Definition and testing, based on task analysis. Immersive displays are intrinsically more complex to handle due to extra degrees of freedom.

Effective precise navigation, selection of objects and point of view are central to a well designed user interface.

A visual summary of key elements of the current CONRAY simulation model is shown below in Figure 4.

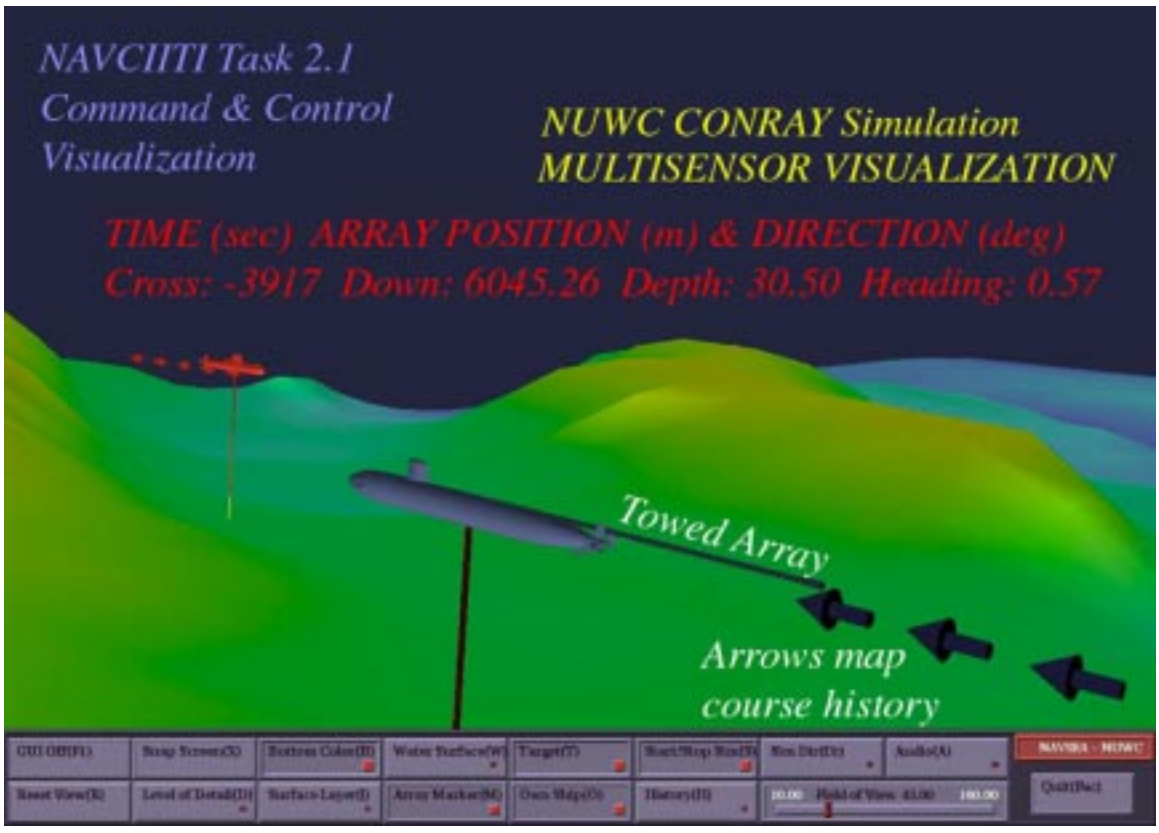

Figure 4. Key element of the current CONRAY simulation model