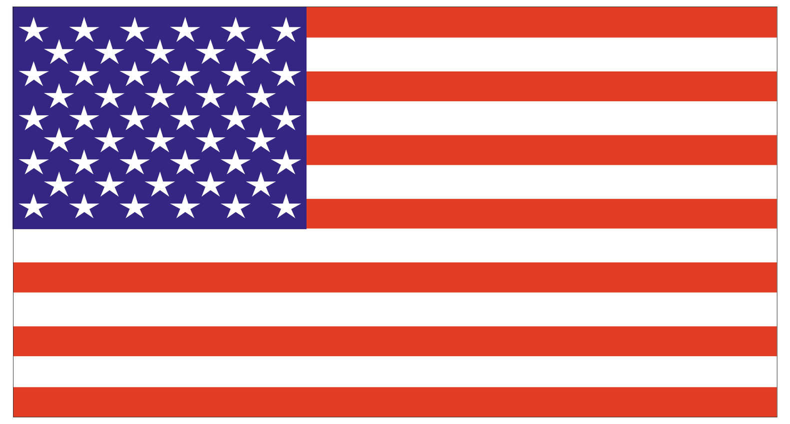

DEVELOPMENT OF A FULLY SUBMERSIBLE COGNITIVE PERFORMANCE BATTERY

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INTRODUCTION

Currently no functioning mechanism exists for measuring the real-time cognitive performance of a submerged diver. This limits the capability of Navy Experimental Diving Unit (NEDU) to make valid, reliable recommendations about how environmental stressors, equipment, or procedures affect mission performance.

In the past, the Systematic Investigation of Diver Behavior at Depth (SINDBAD) battery was used to assess submerged diver performance. Developed in the 1970s, this battery is incompatible with modern operating systems, is cumbersome, lacks portability, and can no longer be used to collect data.

Currently NEDU relies on measures taken after an exposure to measure cognitive performance. However, this method is incapable of determining when decrements in functioning occur or whether deficits subside upon surfacing. Thus, because NEDU lacks a system for collecting real-time performance data from submerged divers, we have developed equipment capable of assessing the cognitive performance of a fully submerged diver.

METHODS

MATERIALS

The equipment, specially developed by Chalco Eleven Ltd., consists of a topside computer, monitor, keyboard/mouse, and communication system that are connected to a control system (Figure 1) that interfaces with the submerged monitor (Figure 2), keyboard/mouse (Figures 3 and 4), camera (Figure 5), and communications system (see Figure 6).

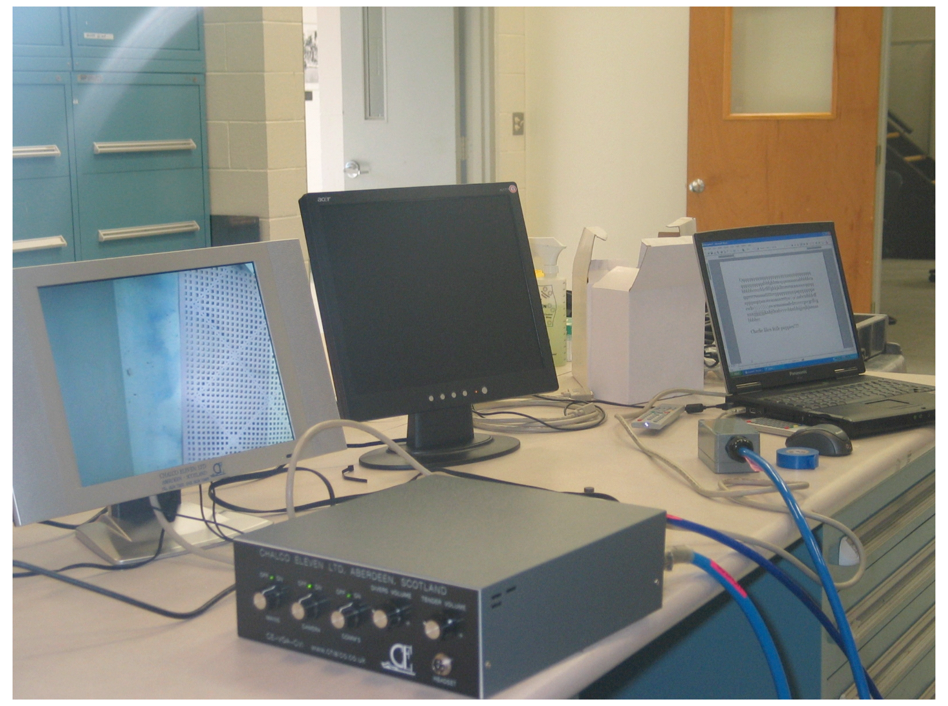

Figure 1. Topside control system, monitor, and laptop.

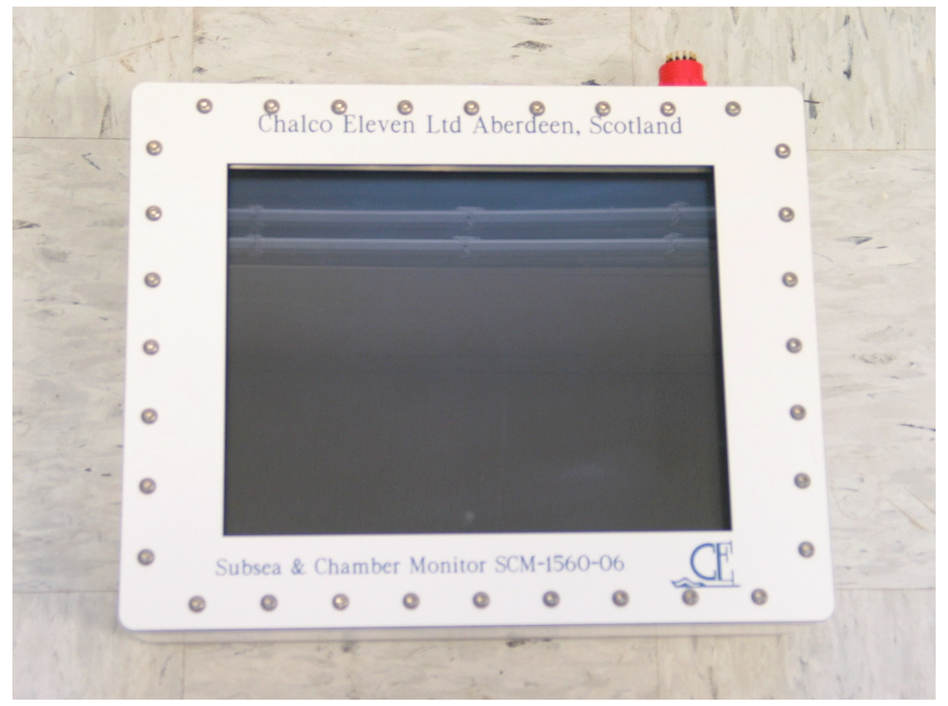

Figure 2. Submersible monitor.

Figure 3. Submersible keyboard and magnetic stylus. This keyboard requires a magnet to operate the keys.

Figure 4. Submersible mouse. The stylus is used on the Left and Right mouse buttons.

Figure 5. Submersible camera.

Figure 6. Set up of the submerged monitor, camera, mouse, and keyboard.

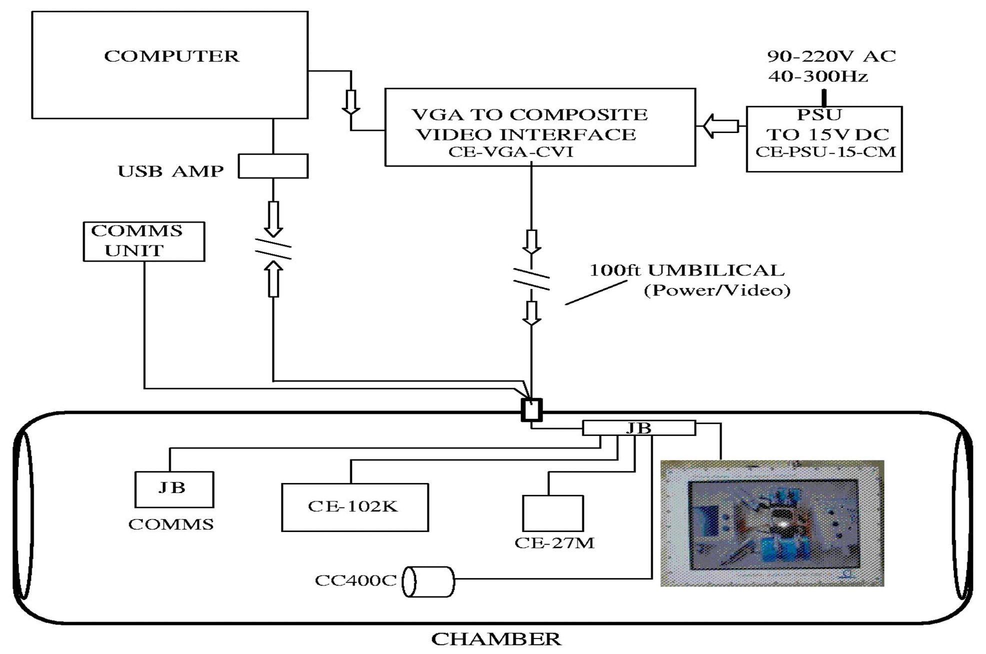

Figure 7. Configuration of the entire system used in a wet chamber. The laptop computer, communication equipment, and video monitor connect to a control system that interfaces with the submerged monitor, keyboard, mouse, camera, and communication system.

RESULTS

The control system stays on the surface and interfaces with the in-chamber/in-water monitor and the computer video signal output, the keyboard, the in-chamber/in-water camera, and the communications system (Figure 7). From a topside location (Figure 1), the researcher can have private communications and interactions with the submerged diver (Figure 6). Various assessments can be controlled and displayed by the researcher as he/she monitors the reactions of the test subject via the camera monitor and computer. The test subject can react by keyboard entries, the mouse, or direct verbal responses.

CONCLUSIONS

NEDU now has the capability to assess the behavior of a fully submerged diver at depths targeted down to 1000 feet of seawater. This equipment is compatible with current operating systems, can easily be transported and deployed, and allows the researcher to assess a submerged diver in real time. Because this equipment is computer based, this system's uses extend beyond cognitive assessments at depth (e.g., it can enhance medical assessments of diver safety needs or communications with a dive team, potentially in the Flyaway Saturation Diving System).