

The Computer Assisted Rehabilitation ENvironment (CAREN) incorporates virtual reality into the assessment and rehabilitation of injured service members. This dynamic system contains a motion platform with an embedded treadmill that moves in sync with virtual environments projected onto a large curved screen.

At the NICoE, service members are referred to the CAREN by their Physical Therapist after clinical evaluations have been carried out in that discipline. The CAREN is a modality that allows clinicians to further explore gait, motion sensitivity, and balance as well as cognitive and visual scanning tasks by using virtual environments specifically developed to have therapeutic value.

## The Virtual Environment

Each virtual environment must be created (graphics, sounds, algorithms for platform motion, etc.) and most are site specific. All NICoE applications are designed to be flexible, so that each environment can be made as easy or challenging as the patient requires or therapist requests. The motion platform and treadmill are synced to move with each environment so there is no disconnect between what patients see and feel. The motion capture system is sensitive to reflection so reflective markers are placed on the patient, allowing them to interact with and/or control their progress through each environment. There are no combat scenarios used on the NICoE's CAREN.

During system utilization, safety is paramount. An acclimation session is required to provide patients with an overview of the technology, a safety brief, and to introduce some preliminary applications. While on the platform, all service members must wear a full body harness and be tethered to the safety stand. Clinicians who choose to remain on the platform must also wear a harness and be tethered. For all clinical sessions, a clinician must be present and a Biomedical Engineer must operate the platform.

## Research and the CAREN

As of October 2013, more than 195 NICoE cohort patients have been referred to the CAREN and over 375 clinical sessions have been completed. In addition to clinical care, the NICoE will develop and validate assessments for service members with TBI and PTSD. These assessments may detect and measure dual-task skills, visual acuity, reaction time, balance deficits, among others. To date, two research protocols that have been approved by the WRNMMC IRB.

### There are currently ten CAREN extended systems in the world:

1. *Brooke Army Medical Center – San Antonio, TX*
2. *Military Rehabilitation Centre – Doorn, The Netherlands*
3. *Naval Health Research Center – San Diego, CA*
4. *Gameship – Leeuwarden, The Netherlands*
5. *National Intrepid Center of Excellence – Bethesda, MD*
6. *Walter Reed National Military Medical Center – Bethesda, MD*
7. *The Ottawa Hospital Rehabilitation Centre – Ottawa, Canada*
8. *Glenrose Rehabilitation Hospital – Edmonton, Canada*
9. *SHEBA Medical Center – Tel Aviv, Israel*
10. *University of Strathclyde – Glasgow, Scotland*