CEAL
CHALLENGING ENVIRONMENT ASSESSMENT LABORATORY

PARTNER INFORMATION PACKAGE
JANUARY, 2011

INTRODUCTION AND OVERVIEW

You are invited to become a part of an extraordinary pioneering research initiative that will advance rehabilitation science in unprecedented ways. The **Challenging Environment Assessment Laboratory (CEAL)** will be one of the most advanced rehabilitation research facilities in the world and will serve to unite first-class scientists and innovators. It is expected to become an international hub where researchers will be able to share inspired ideas, cutting-edge resources and state-of-the-art equipment. The vision for this collaborative partnership will be to build on the contributions and expertise of many investigators from a variety of disciplines and will be easily accessible to researchers, engineers, clinicians and industry partners. Overall, the goal of CEAL will be to develop innovative new therapies and assistive technologies for people recovering from, and living with, disabling injury, illness or age-related conditions. We very much look forward to embarking upon this exciting research endeavour together with you and anticipate a shared future of outstanding scientific achievements and inspired technological innovations that will contribute to improving lives.

The **CEAL** facilities will consist of a large, one-of-a-kind, 6-degree of freedom, hydraulic motion platform that is capable of moving humans in a number of systematic ways (including rotating and translating them in all directions). The platform can be configured with several different, portable, self-contained laboratory spaces that can be physically lifted on to the motion base. An overhead crane will enable the labs to be exchanged easily and efficiently. These interchangeable lab spaces will each have unique features and functions. The labs can either be used in conjunction with the motion platform, or they can be used completely independently while parked in a designated position in the large CEAL laboratory hall (B2). This will allow for the maximum usage of these valuable laboratory spaces.

Currently there are three unique lab spaces within CEAL with the possibility of adding other portable lab spaces in the future (a driving simulator). These are **(1) StairLab** that can be outfitted with modifiable features including an instrumented staircase and a force plate floor **(2) WinterLab** that can simulate different conditions such as cold, wind, snow drifts and ice, and **(3) StreetLab** that contains a high resolution, large field of view (FOV) visual projection system that can be coupled with various movement interfaces (e.g. a linear treadmill, a manual wheelchair with torque-controlled wheels or a joystick controller of a powered wheelchair).

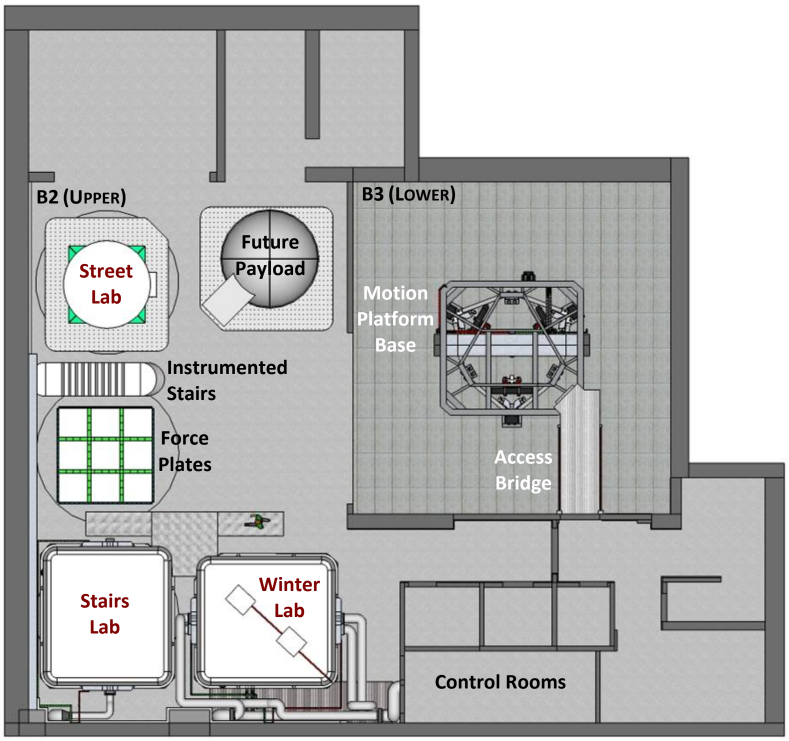
The potential experimental conditions that can be created using these new facilities are vast. For instance, movement disturbances or balance perturbations can be introduced by producing sudden accelerations in any direction. The platform can also be configured to create sloped walking surfaces. The traction of the walking surface can be changed (i.e. by using the ice floor) and movements across uneven terrain can be simulated. The movements of the platform can also be coupled with a corresponding 240° field-of-view visual display to provide realistic simulations of movement through natural environments; for instance, by having an observer physically walk on a treadmill through a realistic, high resolution, virtual replica of downtown Toronto. The simulator can be programmed using motion cueing algorithms to mimic the movement dynamics of real vehicle motion. Not only is this system capable of providing a variety of highly realistic, multi-sensory simulation scenarios (i.e., visual, auditory, tactile, proprioceptive, vestibular, etc.), but it does so safely and with the high level of control necessary for careful scientific evaluation.

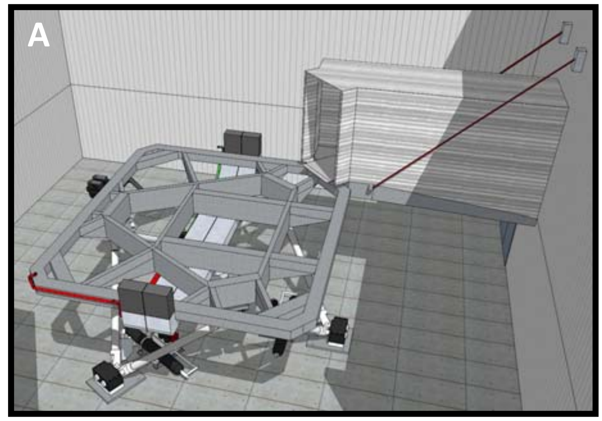
While observers are performing tasks in the simulator, a variety of different measurement devices will be available to optimally track and assess participant performance. These range from precise motion capture systems, portable EEG, ECG and EMG devices, force plates, and a high resolution eye-tracker. Having the ability to accurately characterize even the most subtle aspects of human behaviours under different task constraints is highly valuable when developing tools to improve diagnostic and treatment programs, as well as when assessing the effectiveness of novel assistive devices.

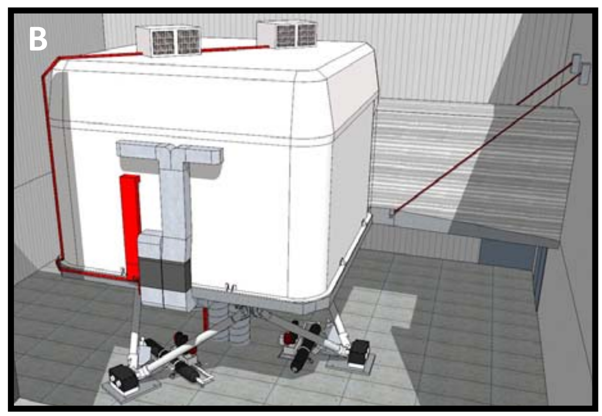
CEAL will be centrally situated in the heart of **Toronto's Discovery District** located below ground in a new building at the **Toronto Rehabilitation Institute** **(Toronto Rehab).** Toronto Rehab is Canada's largest academic adult rehabilitation hospital and is focussed on providing exceptional patient care and conducting cutting edge research. The objectives of Toronto Rehab's research program, referred to as **iDAPT** (Intelligent Design for Adaptation, Participation and Technology), are to perform careful scientific investigations and develop innovative devices and treatments that will advance rehabilitation practices and lead to tangible solutions for real problems.

The goal of this Partner Information Package is to describe the facilities including, the motion base, each of the different lab spaces, the overall safety features, and the measurement devices that will be available. It is intended to provide information that you will need for planning experiments, writing grants, and completing ethics forms. Feel free to directly copy and paste the pictures and text from this document into your applications. The projected date for the commencement of research will be March 2011, now is the time to begin your preparations (Click here to view a live webcam of the construction site). It should be emphasized that if you need information that extends beyond that contained within this summary, you should feel free to contact us at any time using the contact information provided at the end of this document. This summary is also intended to serve as a working document that will be frequently updated as progress continues. The most recent information will always be accessible through the CEAL website (www.cealidapt.com) where you will also be able to download a continuously updated version of this partner information package. We are also more than happy to provide tours of the facilities when they open to those who are interested!

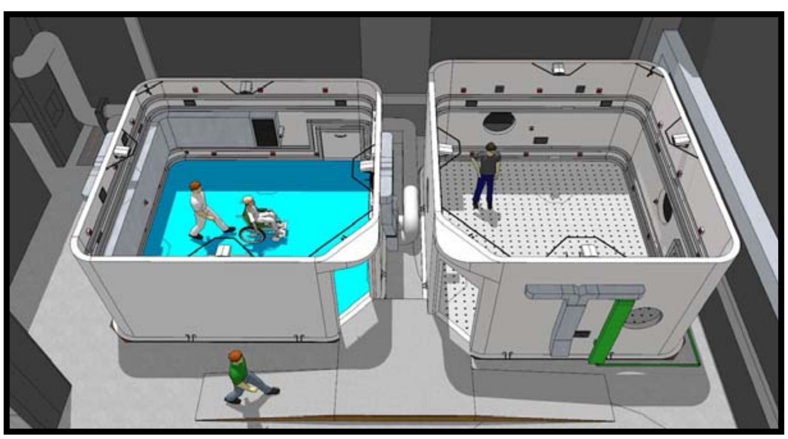
OVERVIEW OF THE FACILITIES







A. Motion platform base alone
B. Lab mounted on the platform. The bridge is lowered to provide access to the payload entrance.



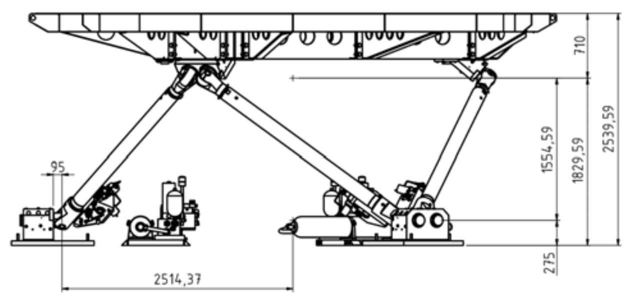
WinterLab and StairsLab as seen from above when parked in B2.

Click here to see a virtual "fly through" of the facilities

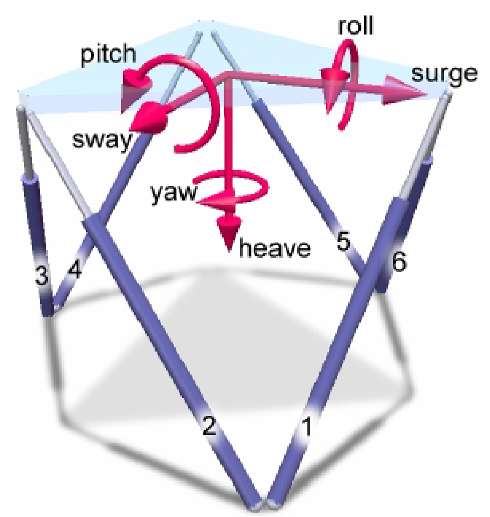
Motion Simulator Base

The motion simulator developed by Bosch Rexroth will have a weight capacity of 12,000 kg with approximately 7,000 kg reserved for the user payload. It is comprised of a triangular shaped frame, on which the labs are mounted. The top of the simulator base rises to a height of approximately 2.5 m off the ground. An access bridge will be raised and lowered to allow participants to move safely and easily on and off the simulator.

The motion base can translate over a range of approximately +/- 1.0 m in x, y and z directions and has a rotational movement range of approximately +/- 25 degrees in pitch, yaw and roll. It is able to produce angular accelerations of approximately 100 degrees/s^2 and linear accelerations of approximately +/- 7 m/ s^2. These values vary depending on several factors, including the weight of the lab and its contents.



The movement parameters of the motion simulator are customizable and will be adapted for the specific requirements of each experiment. It does, however, come equipped with predefined motion cueing algorithms used to model different vehicle dynamics in highly realistic ways. It also incorporates washout filters which enable a slow, “sub-threshold” return of the platform back to centre following a movement in any direction. There are also built-in motion effects, including, simulated turbulence, collisions with obstacles, and ground vibrations (e.g. the vibrations of a passing streetcar when standing on solid ground or the rumbling sensation felt when driving a vehicle over rough terrain).



Click here for an introduction to motion simulation technology at Bosch Rexroth

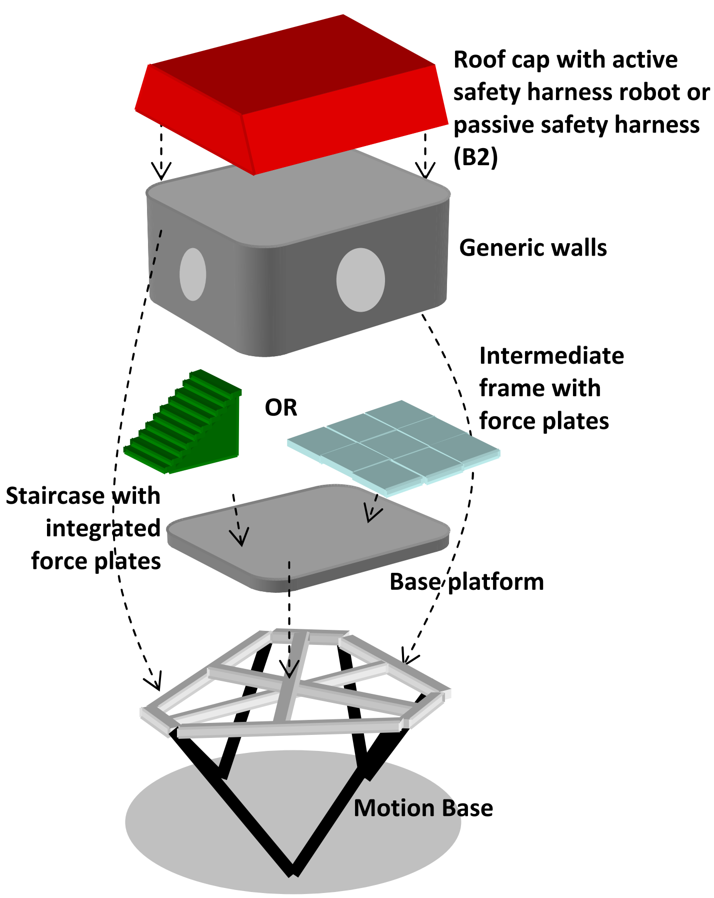
Click here to view a video simulation of the E Motion 11000 motion simulator that will be similar to that used for CEAL

1. StairsLab

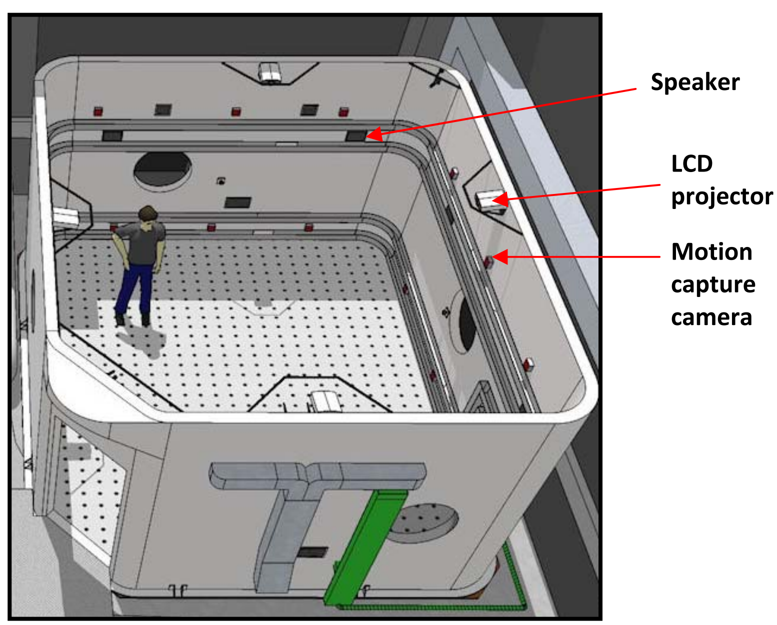
Overview

StairsLab will serve as a modifiable laboratory space that can be tailored to the needs of a particular experiment. The dimensions of the interior, free walking space are 5.55 m (L) x 5.15 m (W) x 3.27 m (H) and the exterior dimensions are 6.0 m x 5.6 m x 4.42 m. This lab space is equipped with generic walls and floor which can be used on their own (i.e. empty of objects or measurement devices) or it can be outfitted with either a) a customized staircase with integrated force plates or b) a floor made up of integrated force plates (see below for more information). Customized furniture can also be installed within this lab space and the outside walls can be used with or without windows that expose the larger CEAL laboratory space. The internal temperature and humidity range within the lab space can also be controlled (ranging from 12°C to 35°C) and can be used to simulate hot or cool climatic conditions.

All three payloads will be equipped with a surround sound system consisting of eight speakers (two per wall), at least one projector (6 high resolution projectors will be mounted in the visual dome), and a high precision motion capture system. When the payload is loaded onto the motion platform, a roof cap with an active robotic safety harness mounted inside will be used and when the payload is parked in the payload hall, a roof cap with a passive safety harness will be used (see additional details for all of these features below).



StairLab schematic

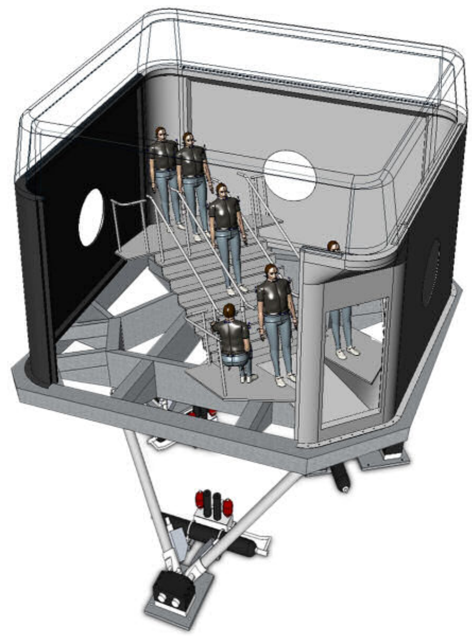


Overhead view of StairLab (without stairs)

Interchangeable Features

Instrumented Staircase

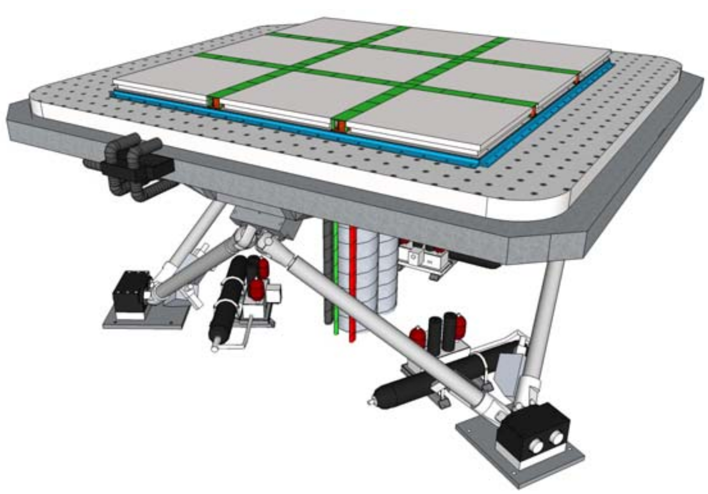
The staircase will consist of 8 steps with 7” risers and 11” runs. The total height/rise of the staircase will be approximately 1.4 m, with a stair width of 2.0 m, and a total length/run of 6 m. The staircase will have “turning stations” at the very top and bottom.



The treads will be made of plywood that can be removed and refinished or replaced. This will accommodate studies using different surfaces, markings and nose sizes. There will be four force plates available that can be installed under four of the treads (http://amti.biz/: AMTI ZBP275600-2000). Also, an interchangeable and instrumented railing system will be incorporated and will be able to measure forces exerted, for example, when recovering from an induced overstep or a trip provoked by a controlled movement of the stairs. These movements can be triggered by the 3D motion system when a predetermined event is detected (e.g. a foot is about to land on a particular step).

Force plate floor

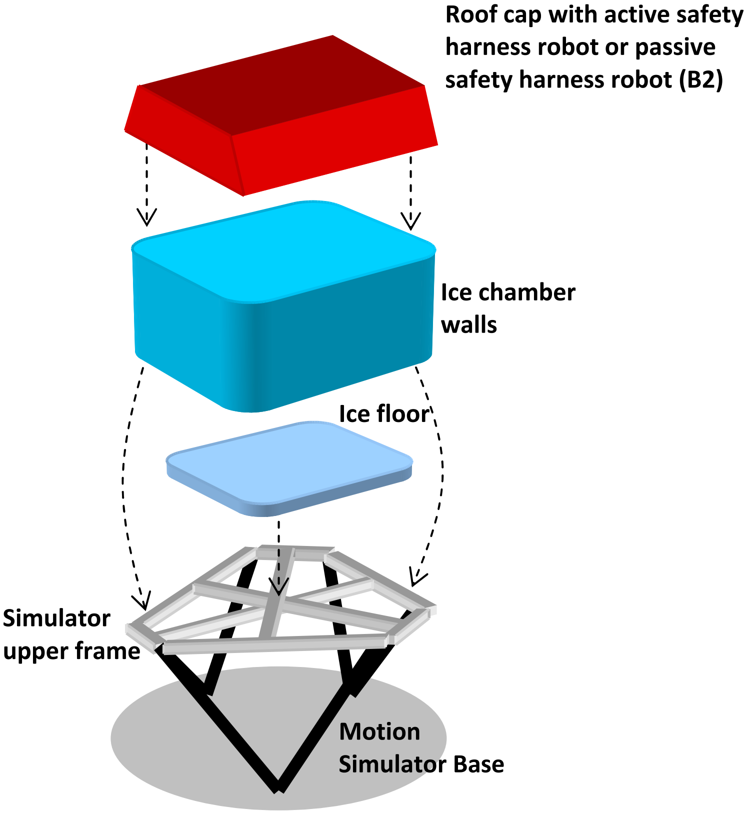
Nine large force plates (http://amti.biz/: AMTI BP12001200 – 1000) measuring 1.2 m x 1.2 m each will be shared between the Falls Lab (see below) and StairsLab. When used in StairsLab, the force plates will be mounted closely together in a 3 X 3 force plate grid. Any uninstrumented empty spaces in the grid will be occupied with filler plates. Together they will form a large (4.5m X 4.5m) instrumented walkable surface area.



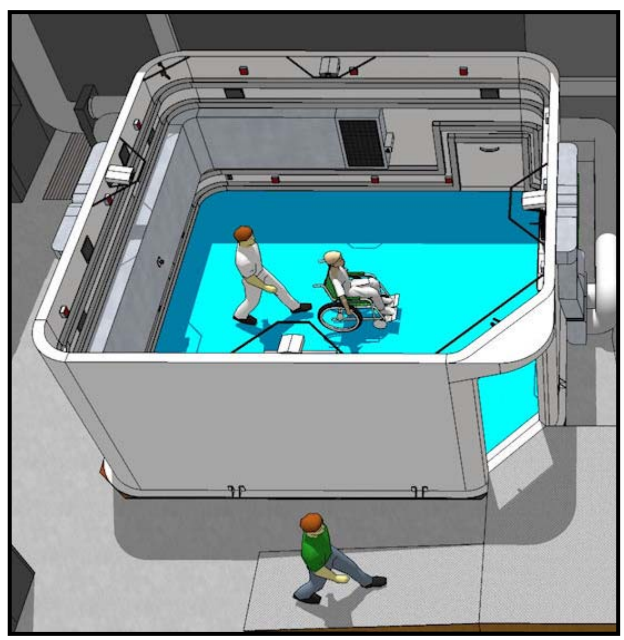
2. WinterLab

Overview

WinterLab will be equipped with a refrigerated ice floor. Its interior dimensions are 5.55 m (L) x 5.55 m (W) x 2.73 m (H) and its exterior dimensions are 6.0 m x 5.6 m x 3.88 m. A special cooling system will provide cold, dry air to simulate winter conditions and a large industrial fan will be able to produce winds up to 30 km/h at -10°C. A portable snowmaker can be wheeled into the lab when the motion platform is stationary, or when it is parked in B2. This snowmaker can be used to generate a covering of snow on any surface or to build snow drifts. Curbs and steps can also be incorporated as a way of simulating real world, winter mobility challenges.



WinterLab schematic

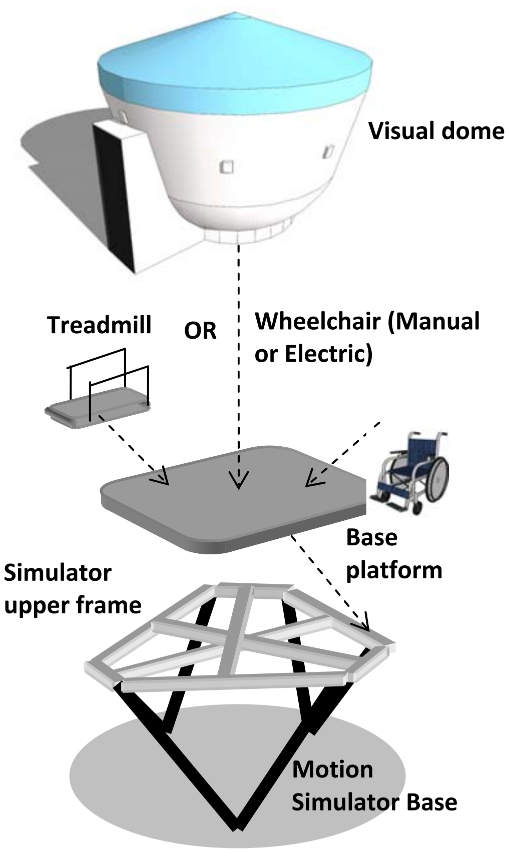


Overhead view of WinterLab interior

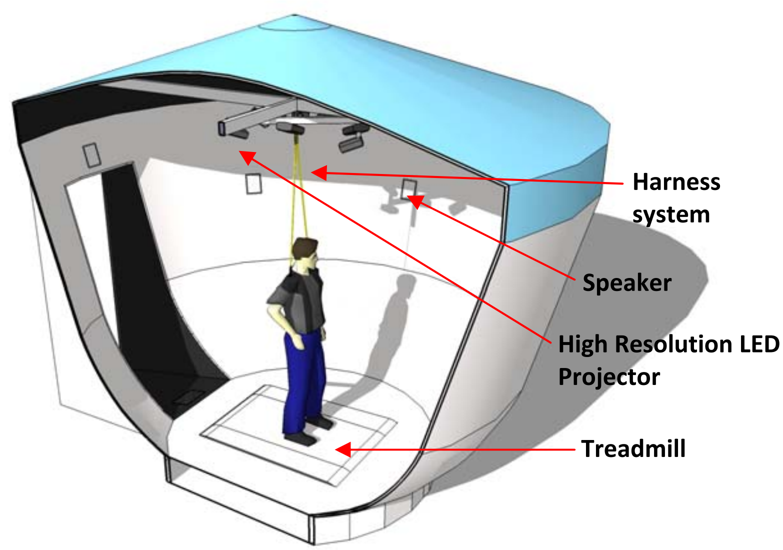
3. StreetLab

Overview

StreeLab will contain a 240° horizontal field-of-view (FOV) visual projection system that will immerse observers within realistic, high resolution Virtual Environments (VEs). LED projectors will be used to display a seamless image on the walls surrounding the observer and also on the floor. Observers will be able to move through the VE by walking on a stationary treadmill, or by manoeuvring a manual or powered wheelchair. As the observer moves, the projected visual information will be coupled to their movements in real time. The roof cap of StreetLab will have an anechoic lining built into the ceiling to dampen sound reverberations from the equipment and/or the surround sound system. While the VE will be customizable for each research project, we currently have developed an extremely high resolution, virtual rendering of the city block surrounding Toronto Rehab; even down to the level of cracks in the sidewalks! (see images below). This VE includes intelligent vehicles and pedestrians that interact with the user and adjustable traffic signal timing. A realistic 3D soundscape is integrated with the visual model.



StreetLab schematic



StreetLab shown with a participant walking on the treadmill

Figures 1 and 2: The images on the left (1A and 2A) are actual photographs of locations in downtown Toronto and the images on the right (1B and 2B) are taken from a 3D virtual simulation of the same approximate locations. The simulations will also include intelligent pedestrian and vehicle traffic.

Interchangeable Features

Treadmill

A durable, single belt, motor-driven treadmill can be used in conjunction with the visual display within StreetLab. The walking surface area of the treadmill is white to allow for image projection. It is 0.56 m X 1.27 m in size and can move up to 3.1 mph with a resolution of 0.1 mph. Adjustable handrails are optional and a 3D motion measurement system will also be available.

Manual wheelchair

A manual wheelchair will be fitted with wheels that are supported slightly clear of the ground. The virtual motion of the chair through the simulated environment will be controlled by data from optical encoders on the shafts of the wheels. Torque motors will simulate rolling resistance and wheeling up and down slopes.

Electric wheelchair interface

It will be possible for users to “drive” an electric wheelchair through a VE by manipulating a joystick controller while coupling these inputs to the visual movements in the VE.

Measurement Tools

- ***Motion capture systems:*** The motion capture systems will use small markers placed on a participant's body to detect and record information about their movements. A mounting system will be incorporated into every laboratory so that a motion tracking system will be available in each.

- ***Force Plates:*** Nine large force plates measuring 1.2 m x 1.2 m each will be shared between the Falls Lab (see below) and StairsLab and four smaller force plates will be mounted under the treads of the instrumented staircase.

- ***Telemetry EMG (x2):*** Two wireless systems each measure and record 16 muscle sites and transmit this information by radio frequency waves up to 275 m away.

- ***Ambulatory Micro EEG:*** A portable EEG system used to measure electrical brain activity at the scalp while participants perform various tasks.

- ***Eye Tracker:*** This high resolution, head-mounted eye-tracking system can track eye movements at up to 360 Hz.

- ***Gait analysis system:*** A mat with embedded sensors records and saves footfalls and different gait parameters such as, walking cadence, stride length and step width.

- ***Ambulatory gas analyser:*** Measures gas exchange such as oxygen uptake, carbon dioxide output, and ventilation and anaerobic thresholds.

- ***Ambulatory cardiovascular measurement device:*** This system is a vest worn by participants and collects data using respiratory bands (to measure pulmonary function) and ECG recordings (to measure electrical activity of the heart). It also tracks and records posture and physical activity. Optional peripheral devices can monitor EEG, skin temperature, blood oxygen saturation, blood pressure and galvanic skin response.

- ***Microphones:*** Two microphones will be installed in each laboratory and can be used to record verbal responses or reactions during various experimental tasks.

- ***Accelerometers and Load Cells:*** These devices will be attached to objects within the simulator and, for example, can be used to trigger an event when contact is made with an object (e.g. when grasping a doorknob or a handrail).

- ***Analog/Digital trigger inputs***: Various input devices will be available to record different participant response measures, and will include joysticks or other potentiometers, button boxes, steering wheel, etc.

Stimulus Presentation Systems

- ***Surround sound system:*** An array of eight speakers (two per wall) will provide surround sound to participants. This sound can be used, for instance, to increase the realism of a Virtual Environment, to provide realistic challenges to those using augmentative communication aids, as a source of distraction for subjects attempting to perform particular functional tasks, or used simply to mask the noise produced by the equipment. There will also be access to a 3D sound database that contains a wide selection of common, everyday sound sources.

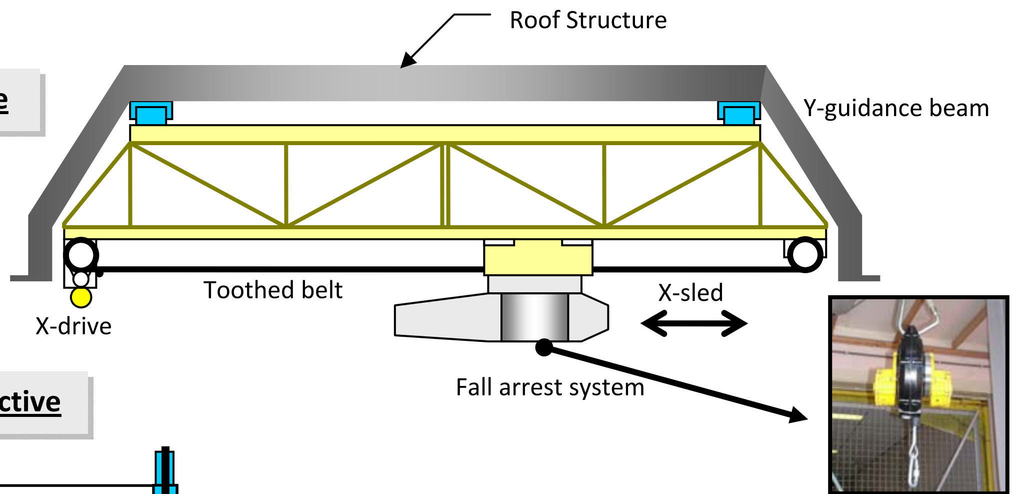
- ***Projector systems:*** LCD projectors will be available inside WinterLab and StairsLab and will be used to project images on the opposite wall. For instance, images will be projected onto the walls as a way of helping occupants orientate themselves by providing a frame of reference. At least 5 (and up to 13) higher resolution LED projectors will be used in StreetLab as described above.

Safety Devices

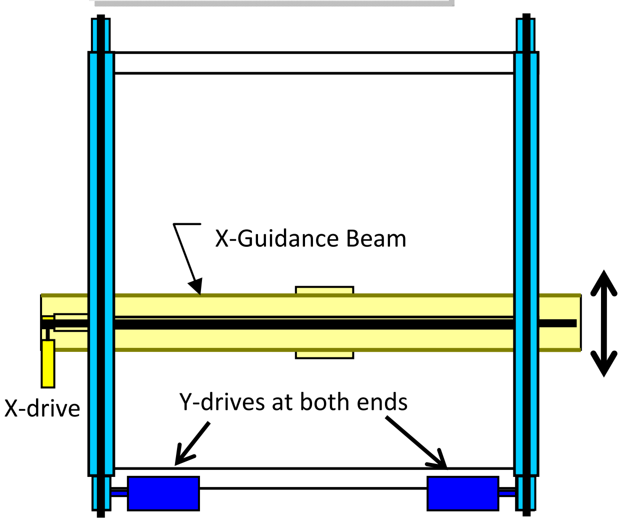
- ***Safety harnesses:*** Two different safety harness systems will be installed into two separate roof caps that can be interchangeably mounted onto WinterLab and StairsLab. The Passive Safety Harness system will be used when the labs are parked in B2 and the Active Safety Harness will be used when the labs are loaded on to the motion platform (B3). The Active Safety Harness will also provide individual support to a second person ('safety spotter') who will hold a dead man's switch. StreetLab will have a separate, single point safety harness.
  - ***A. Passive Safety Harness System**:* This system consists of a single rail onto which a safety harness can be attached. Once on the rail, the harness can slide from one corner of the roof to the opposite corner (i.e. along the diagonal extent of the lab space). A mechanical fall-arrest device (descent controller) will ensure that, in the case of a fall, the subject will be lowered to the floor very slowly *(North Safety, FP2515GD)*.
  - ***B. Active Safety Harness System:*** The active safety harness robot consists of a powered x-y gantry system installed in the roof (see figure below). As such, it will be able to accommodate movements in both x and y directions, allowing for unrestricted walking throughout the entire lab space. It uses a mechanical inverted joystick that measures the cable angle attached to the occupants and uses this information to track their movements throughout the platform. The occupants will wear a body harness that will be attached to the fall arrest device on the robotic tracking mechanism with a fall arrest cable.

Active Safety Harness System

Profile Perspective



Bottom-up Perspective

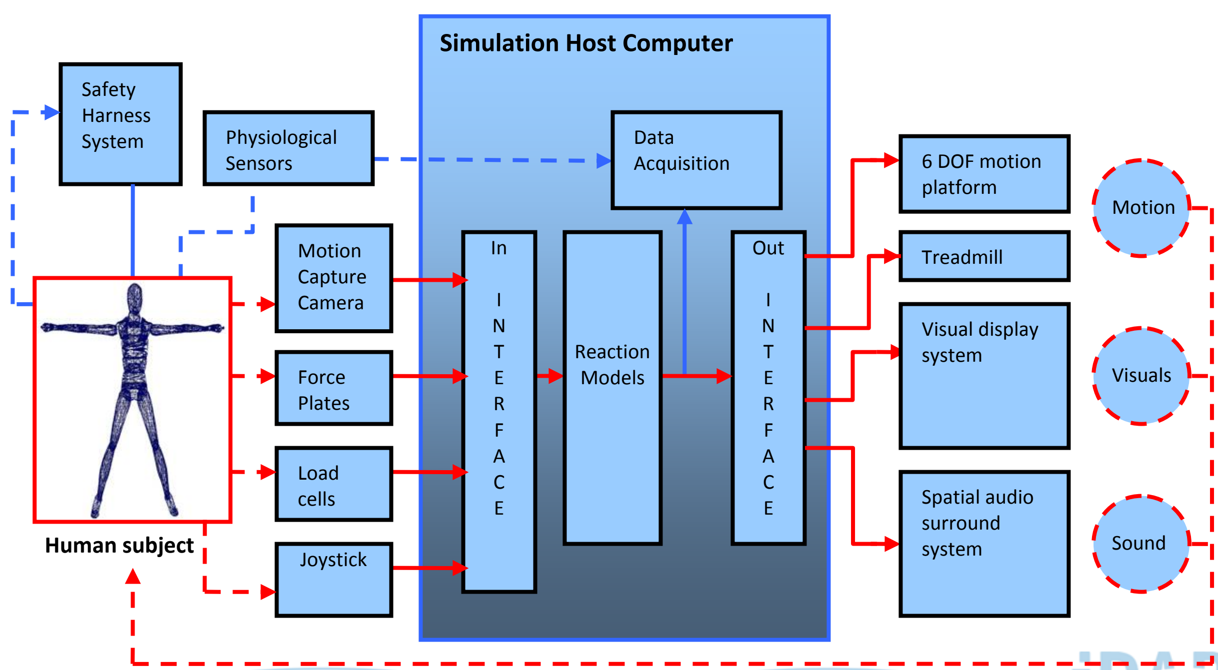


- ***Dead-Man Switch:*** If this switch is released, the simulator and the x-y gantry system will automatically freeze.
- ***Infrared video surveillance system (two cameras per lab):*** Will allow the occupants of the lab spaces to be seen from the control room at all times, when the interior is both illuminated and in darkness.
- ***Smoke detectors***
- ***Carbon-dioxide and Carbon-monoxide level detectors***
- ***Intercom system***
- ***Voluntary stop buttons in the control room***

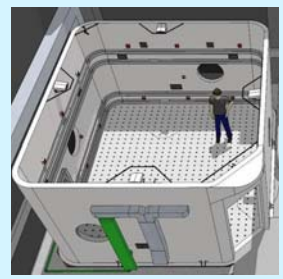
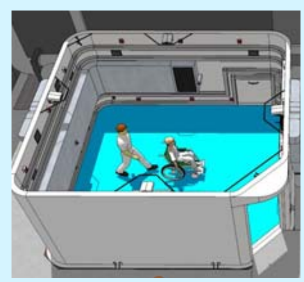
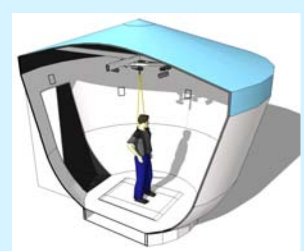
REAL TIME COMPUTING SYSTEM

The signals from the various different measurement devices (motion capture cameras, force plates, joyticks, etc.) are connected to a simulation host computer which monitors and controls all of the different simulation systems in real time (See figure below for a schematic). The information collected from these devices can then be used for several purposes. First, it will be time-stamped and saved for post-experiment analysis as a way of precisely measuring participants' responding and behaviour. Second, it will be incorporated into reaction models which will be used to dictate the responses of the various interfaces, including, the motion platform, the treadmill, the visual display system (e.g. the VE), the audio cueing system, etc. For example, it order to create a fall scenario on the instrumented stairs, the reaction model might specify that as soon as a participant's foot exerts a particular force on a specific step, the motion platform will then be accelerated rapidly. Similarly, for a vehicle control model, when a participant turns the steering wheel, the visual movement through the Virtual Environment will be updated accordingly and the motion platform will move appropriately. The expected latency of this process, from measurement system output to simulation system input is less than 25 ms and the simulation host computer shall operate at a frequency of at least 100 Hz.

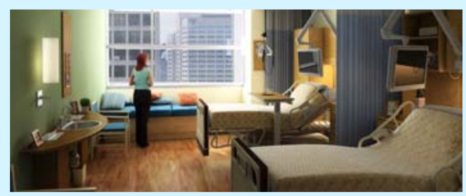
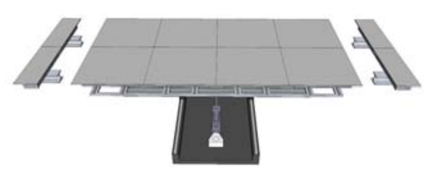
There will be separate host computers for each lab space and, therefore, each can run independently in B2 and B3. There will also be multiple master PC's (or laptops) that will interface with the host computers. Users can prepare their experiments off-line on a remote computer, adjust all of the necessary parameters and upload their program on to the host PC. They will then be able to perform test runs and execute their experiment on the simulator in real-time.



SUMMARY OF CEAL LAB SPACES

RESEARCH LAB	INTERCHANGEABLE FEATURES	STANDARD FEATURES	LINK TO ADDITIONAL INFORMATION
STAIRSLAB	• Empty floor • Instrumented Staircase • Force plate floor • Customizable furniture	• Generic walls • Base floor • Motion capture cameras • Audio surround system • LCD projectors • Roof cap with active or passive safety harness	
WINTERLAB	• Steps and curbs	• Ice chamber walls • Ice floor • Wind fan and super cooled air • Motion capture cameras • Audio surround system • LCD projectors • Roof cap with active or passive safety harness	
STREETLAB	• Treadmill • Wheelchair simulator (Manual and Electric)	• Visual dome • Immersive, large FOV, visual projection display • Motion capture cameras • Audio surround system • High resolution LED projectors • Passive, one-point safety harness	

ADDITIONAL iDAPT LABORATORIES

LABORATORY	DESCRIPTION	
HOMELAB	Located on the 12th floor of the hospital, this laboratory will be capable of testing assistive technologies in a typical home setting. It will feature a single-storey dwelling to facilitate the development of new tools that will help people overcome the challenges they face in their own homes. Research will focus on easing the burden of caregivers and increasing the independence and safety of people with disabilities. An overhead catwalk and suspended grid will enable devices, such as overhead lifts and ceiling-mounted monitoring systems to be tested.	
CARELAB	Located beside the Home Environment Lab will be a typical institutional care room with an en-suite bathroom. The Institutional Environment Laboratory will enhance investigators' understanding of the physical effort of patient care and help develop new technologies (including robotic systems) to assist with lifting, moving, repositioning, toileting, washing, dressing and other care tasks. The laboratory will be the final testing ground before applying the technologies in actual patient rooms.	
FALLSLAB	The Falls Lab will house a motion-platform for studying balance control. This platform will be 7 m x 3 m and is made up of 8 large force plates (a 4 X 2 grid of 1.5m X 1.5m force plates). It will allow unpredictable balance disturbances to be applied in a well-controlled and safe manner while subjects engage in various tasks. The platform will be used to study compensatory reactions to unexpected perturbations created by platform movements in the horizontal plane. These movements can be random or can be triggered by an event (e.g. a force plate or motion system event). The platform is capable of high accelerations and velocities with total displacements of up to 2m in the horizontal plane. The motion path can be linear in any direction or can be comprised of combinations of different X and Y motions during gait, stance and seated postures. This lab will accommodate studies that do not need the full 6 degree of freedom capabilities of the CEAL motion simulator and which may benefit from the longer walking distances, greater availability and lower cost of operation.	

LABORATORY	DESCRIPTION	
MOVEMENT EVALUATION LABORATORY	The Movement Evaluation Laboratory will be embedded within a clinical area of the hospital (9th floor). It will include systems used to conduct motion (motion tracking), kinetic (force plates) and spatiotemporal (pressure mat) analyses. Detailed measurements will be made of the nervous system (electroencephalography, peripheral stimulation), musculoskeletal system (electromyography, isokinetic dynamometer), and cardiorespiratory system (metabolic cart, electrocardiography, blood pressure). Training equipment (treadmill with body-weight support, and specialized ergometers) will be used for ongoing trials.	
COMMUNICATION FUNCTION LABORATORY	The Communication Function Laboratory (CFL) is located in the University of Toronto's Rehabilitation Sciences Building at 500 University Avenue. The main focus of this lab is on the development of new technology to assess and augment communication in a natural environment and to develop theories to aid in the design of speech and hearing technology. The focal point of this lab is a sound-insulated room that is equipped with a state-of-the-art array of speakers and audio equipment specifically designed for the study of communication in complex acoustic environments. CFL also houses clinical audiometers, and middle ear, brainstem, and otoacoustic emission analyzers. Additionally, the laboratory will test the effectiveness of interventions designed to help people with communication disabilities to understand or produce words in challenging environments. These include hi-tech hearing aids and state-of-the-art augmentative/alternative communication (AAC) units such as communication boards and voice output computer aids.	

WORKSHOPS

iDAPT's cutting-edge design studio and workshops (see table on next page) provide a unique collaborative research environment where products (such as research equipment or assistive devices) can be designed, prototyped and studied, and clinical testing can be organized seamlessly and efficiently.

Researchers and students with backgrounds in engineering, industrial design, architecture and other clinical specialties collaborate in this workspace customized for creative computer graphics and concept modelling. The studio is equipped with sophisticated computer-aided design (CAD) workstations, printers/plotters, exhibit and modelling space and an integrated team meeting space.

Workshop services include mechanical and electronic design, rapid prototyping, stress analysis, kinematic analysis and industrial design (see additional details below). These services are available for use by our academic and commercial partners as a way of testing innovative solutions quickly and efficiently prior to commercialization.

WORKSHOP	DESCRIPTION	
MECHANICAL WORKSHOP	The Mechanical Workshop is equipped with the latest computer-controlled machine tools including, ultra-high precision five-axis milling, a live-head turning centre, micron level surface grinding, plasma and torch cutting, MIG, TIG and stick welding, as well as a variety of numeric controlled machines.	
ELECTRONICS DEVELOPMENT WORKSHOP	The ability to develop and prototype high quality miniature electronic devices is integral to iDAPT's success. This workshop is equipped with sophisticated electronics, CAD and circuit simulation software, hardware and software toolsets for the development of embedded applications employing a wide variety of microcontrollers, state-of-the-art test and measurement instruments, and rapid in-house electronics prototyping equipment. This allows researchers and engineers to quickly fabricate and test experimental solutions, significantly reducing the time required for design revisions prior to commercialization.	
RAPID PROTOTYPING WORKSHOP	Three-dimensional prototypes can be manufactured with unprecedented speed, function, sophistication, and style in this high-tech workshop. With part resolutions down to .004" and a build envelope of 20.5" x 20.5" x 12.5" this 3D Systems Stereolithography (laser cured photo resin) machine is one of the largest in Canada. Complex parts are now available without the high cost of tooling and moulding. Robust functional parts are achieved with a Dimension-Stratasys Fused Deposition Modeling machine. Liquid ABS plastic is extruded out of a printer head with resolutions down to 0.010" and a build envelope of 6" x 8" x 6". Assemblies and even gear trains may be created in-situ (with tolerances) all in one build.	

CEAL Partners and Collaborators

This list includes some of the universities, institutions, foundations and industry partners involved with CEAL. We very much look forward to expanding our list of partners in the future.

Research Partners

Algoma University
Bloorview Research Institute
Carnegie Mellon University
Centre for Addiction and Mental Health (CAMH)
Dalhousie University
Lakehead University
Laval University
Max Planck Institute for Biological Cybernetics, Germany
McGill University
McMaster University
Neil Squire Foundation
Nova Scotia College of Art & Design
Ontario College of Art and Design (OCAD)
Ryerson University
Simon Fraser University
Stair and Railing Association of Canada
Sunnybrook Health Sciences Centre
State University of New York
Toronto Western Hospital
University of Alberta
University of Calgary
University of Florida
University of Guelph
University of Iowa
University of Manitoba
University of Ottawa
University of Toronto
University of Waterloo
University of Western Ontario
Wilfrid Laurier University

Industrial Partners

Funding Partners

Examples of Proposed Research Projects

- *Assess how stair and handrail design affects gait characteristics, postural control, the incidence of falls and the success of recovering from trips and oversteps*
- *Develop and test new stair-climbing mobility aids*
- *Evaluate the performance of assistive devices in winter conditions*
- *Develop and test new clothing and footwear designs that are easier for older people to don and doff and that provide greater comfort and safety in winter*
- *Test the stability of mobility aids (including walkers and wheelchairs) on various levels and inclined surfaces (including snow and ice) and during movement perturbations*
- *Examine the role of simulated visual feedback on locomotor rehabilitation therapies using Virtual Reality*
- *Optimize simulated physical movements and simulated visuals in order to best approximate those in the real world. Understanding the importance of these factors in rehabilitative research.*
- *Investigate the influence of different sources of sensory information (including visual, auditory, proprioceptive, vestibular, tactile, etc.) on task performance.*
- *Develop and test ubiquitous monitoring and prompting technologies to help people with Alzheimer's and other dementias function more safely and with reduced caregiver stress at home*
- *Develop and test advanced robotic technologies to help with the physical care of mobility-dependent people at home and in healthcare facilities*

TIMELINE

TARGET	PROJECTED DATE
Workshops move in to new building	May, 2010
Workshops operational	June, 2010
Motion simulator base and lab spaces are delivered and installed	June, 2010
Assembly of lab spaces	July, 2010
Safety and acceptance tests/inspections	September, 2010
Experiments can begin!	March, 2011
Other iDAPT Laboratories completed (e.g. Falls Lab, Home Environments Lab, Institution Environments Lab),	March, 2011

FREQUENTLY ASKED QUESTIONS

When should I start planning my experiments?
Right away! The building will be completed by Fall 2010 with CEAL expected to be fully operational by February 2011. It will be important to start thinking about including CEAL experiments in your upcoming grant proposals and when applying for, or renewing ethics applications. We will facilitate this process in any way that we can. Feel free to copy and paste any content included within this package and use it in your proposals. Do not hesitate to request additional information or materials.

How will ethical approval be obtained?
Ethical approval must be obtained from both Toronto Rehab and your own ethics review board. We will facilitate this process by posting all Toronto Rehab ethics forms on the CEAL website and by filling out any generic portions that are applicable to all experiments conducted using CEAL. You are encouraged to submit these forms well in advance of the projected start date of your experiments.

What if my research program is not based out of Toronto?
We will try to provide as much practical information related to extended stays within Toronto. This includes information about inexpensive accommodations, public transit systems, eateries, etc. We will also provide you with an individual workspace including a desk, computer and lockable storage unit so that you can work comfortably and effectively during the length of your project.

Who will operate the equipment?
CEAL will be staffed by a full-time engineer who will be responsible for programming your experiments and operating the motion simulator. When the labs are parked in B2, researchers will be able to conduct their own experiments after they have been fully trained on the safety features and operational instructions.

What will be the financial cost to me?
When planning experiments using CEAL, researchers will be expected to cover a portion of the operating costs. Our goal is to make these costs as affordable as possible! A full breakdown of the estimated costs will be provided to researchers based on their individual research proposals. These costs will include the overhead costs of running the simulator, a portion of the salaries including the CEAL engineer, programmers and research assistants (if you use them rather than bringing your own), the cost of customized equipment, etc. For grant applications you should also include in your estimated costs those related to subject compensation fees, additional software licences (if not already available at Toronto Rehab), travel costs associated with extended stays in Toronto (if necessary), etc.

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Links of Interest
CEAL website (www.cealidapt.com)
Frequently updated birds-eye view of construction site
iDAPT website
Research at Toronto Rehab
Annual Research Reports
IDT Engineering

How to find us