Virtual, Mixed, and Augmented Survey Project – Canada

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1.0 INTRODUCTION

This document identifies Canadian sources of expertise and capability in Virtual, Mixed, and Augmented Environments. The survey identifies Canadian sources within the Department of National Defence Canada, Industry, and Academic Sectors. The survey was conducted by Greenley & Associates Inc. (G&A Inc.) in 2004.

1.1 Background

Virtual Environments (VE) can potentially support cooperative work among users who may or may not be physically distributed. Virtual environments are being used for many purposes, including training, simulation and operational applications.

A research task group (RTG 042) of the Human Factors and Medicine (HFM) panel of NATO has been established to progress the use of virtual environments for intuitive human-system interaction. The work elements of the RTG include an investigation of the potential of virtual, mixed and augmented environments as a means of providing an advanced and intuitive human-system interaction for multiple military applications and a report on the state-of-the-art and its potential. An international compendium of military, academic and industrial capabilities is being established to aid the progress of the RTG.

1.2 Objective

The objective of this document is to provide a national review of Canadian capabilities (Military, Industry, and Academic) that will contribute to the RTG's international compendium.

1.3 This Document

This document is structured according to the following sections:

- Introduction: this section provides a brief overview of the background and overall objectives of the study.
- Method: this section outlines the methodology used to conduct the survey.
- Results: this section presents all sources that were identified; each source is described in terms of the following: Background, Technology/Hardware, Publications, Contacts, and Electronic Links.

2.0 METHODOLOGY

The World Wide Web was the primary medium utilized for conducting the survey and collecting the information for each source identified. The keywords used to conduct the search on the World Wide Web are outlined in Table 1.

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Table 1: Keywords used in World Wide Web Search

Virtual Environment Mixed Environment Augmented Environment Virtual Reality Mixed Reality Augmented Reality	+	University Research Technology Tools Collaborative Distributed Shared Laboratory Center Training Equipment Hardware Device Consulting Avatar Capability

Information was also collected by identifying contacts through previous work, contacting them via e-mail, and requesting information relevant to the objective of the survey.

3.0   RESULTS

The sources identified in this survey are categorized according to the Military, Industry, and Academic domains. A listing of the sources is outlined below:

Military
- Armoured School
- Army Experimentation Centre
- The Army Simulation Centre (ASC)
- Defence Research & Development Canada – Atlantic
- Defence Research & Development Canada – Ottawa
- Defence Research & Development Canada – Suffield
- Defence Research & Development Canada – Toronto
- Defence Research & Development Canada – Valcartier
- Joint Command and Staff Training Centre (JCSTC)
- Weapons Effects Simulator (WES)

There is a vast amount of resources that were not available through web-search, but are known to exist within the Canadian Forces (CF) through word-of-mouth or common knowledge. In many cases, websites that should represent CF organizations that either provide or use an M&S capability are either non-existent or are no longer active. Operational Research Groups, Army, Navy, and Air Force simulation and experimentations

centers are notable organizations that are not well represented on the web. For this reason, the activities reported in this document do not fully capture the use of virtual, mixed and augmented environments by the Canadian Forces or the Department of National Defence Canada.

Industry
- Adacel Inc., Services Group
- AEgis Simulation Technologies, Inc.
- Amixima Corp.
- Arius3D
- Atlantis Systems International
- Barco
- CAE
- CMC Electronics
- CMLabs
- CyberWorld, Inc.
- Digital Image FX
- eNGENUITY Technologies
- Fakespace Systems
- Fats Canada Inc.
- General Dynamics Canada
- Greenley & Associates Inc. – Simulation and Visualisation Centre
- The HFE Group
- I-mmersion
- InSpeck Inc.
- The Learning Edge Corp.
- Lockheed Martin Canada
- Macdonald Dettwiler and Associates Ltd.
- Manitoba Virtual Reality Centre
- NRC Institute for Information Technology
- NRC Virtual Environment Technology Center
- SAFEWORK Inc. Human Modeling Technology
- Tactical Technologies Inc.
- Thales Systems Canada
- Vivid Group Inc.

Academic
- Bell Canada University Labs
- Carleton University – Aviation and Cognitive Engineering (ACE) Lab
- eyeTap Personal Imaging
- McGill University Center for Intelligent Machines

- Queens University – Touch Laboratory
- Queens University – Visual and Auditory Neurosciences Laboratory
- Ryerson University – Virtual Environment Laboratory (VEL)
- Schlumberger iCentre
- Sheridan College – Visualisation Design Institute (VDI)
- Simon Fraser University – School of Interactive Arts and Technology
- University of Alberta – Department of Computer Science
- University of British Columbia
- University of Calgary – Computer Science Department
- University of Laurentian – Virtual Reality Laboratory
- University of Ottawa
- University of Quebec in Outaouais (UQO) – Cyberpsychology Lab
- University of Toronto – Ergonomics in Teleoperation and Control Laboratory (ETC Lab)
- University of Waterloo

Each source is further described in the subsequent section of the report. Each source is described according to the following: Background, Technology/Hardware, Publications, Contacts, and Electronic Links.

A

Military – Armoured School

Background
No information provided

Technology/Hardware
Cougar Crew Gunnery Simulator (CCGT)
Built to simulate the turret of the Cougar, it is a two-position trainer, for the Crew Commander and Gunner. The hardware replicates the actual environment as far as space and equipment is concerned. The simulator allows crew to practice direct engagement and semi indirect engagements. It does not currently support networked simulations. The imagery is computer generated; 100 predefined scenarios enable immediate use. The simulator was designed for transport within a ten-ton truck. The instructor position consists of a station with two monitors that allow the instructor to observe what either crewmember is looking at through their sight. The instructor is able to monitor operation of the controls and switches and is able to induce faults, such as misfire. The simulator allows the engagement of both static and moving targets while from a static firing position. The operating system is windows based. The simulator was built in Montreal at Simtran.
Leopard Crew Gunnery Trainer (LCGT)
This device simulates being on the Commander/Gunner side of the Leopard turret. The hardware is built to simulate the actual turret. It has greater functionality than the CCGT, including improved computers, graphics and more options for instruction. The simulation provides the ability to fire on the move, and creation of much more elaborate scenarios to practice fire and movement. The simulation affords the possibility of being expanded by building a driver's station and loader's position. Both simulators offer an out of hatch view to the commander. The LCGT does so with a 17 monitor while the CCGT provides an external view through the use of binoculars. The LCGT is Unix based. It was developed by Siemens in the Netherlands as part of the Leopard Thermal Project.
Lav Crew Gunnery Trainer
Built for Light Armoured Vehicle gunnery training, this system shares most of the same functional characteristics as the LCGT, although it is an appended training system - thus it requires a Coyote/Lav to be used. The simulator was built by Simtran.

Publications
No publications provided

Contacts
No information provided

Electronic Links
http://www.army.forces.gc.ca/armour_school/index_e.htm

Military – Army Experimentation Centre

Background

The AEC was created in late 1998. Its first director was given the task to determine its optimal capability in terms of processes, infrastructure and personnel expertise, and to conduct its mission analysis with the view to supporting the development of concepts and other Land Staff activity. It has implemented an experimentation process, which adheres to sound scientific method principles, and has developed several plans to ensure its evolution over the next decade. Its configuration is based on its preliminary mission to assist in the development and validation of concepts for operations throughout the Spectrum of Conflict at brigade and below. Initial emphasis will be placed on command and command support at battle group level.

Technology/Hardware

Motorola ModIOS® Box

ModIOS Box is an exercise management package that enables the management of live, virtual and constructive simulation through a commercial PC workstation.

The Canadian Army Experimentation Centre plans to use the ModIOS Boxes to assist their experimentation process through a complete two-dimensional (2D) and three-dimensional (3D) exercise environment on a Dell® workstation computer.

The Army Experimentation Centre successfully used the ModIOS Boxes to observe, manage, record and debrief its recent Light Armoured Vehicle (LAV) 3 experiment, Army Experiment 5 (AE5). The purpose of these experiments was to establish and test tactics, techniques and procedures at the company, group and combat team level.

Publications

No publications provided

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Electronic Links

http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/symp/cde/chap4-b3_e.asp

Military – The Army Simulation Centre (ASC)

Background

Following the establishment of the AEC, the Army re-examined control of M&S within the Army. The Director Land Synthetic Environments (DLSE) is responsible for directing and managing a large portion of the Army's synthetic environment. He is responsible for Concepts, Doctrine and Training and the M&S facilities at the AEC and the Joint Command and Staff Training Centre (JCSTC). The ASC was established on 23 June 2000, in Kingston, Ontario. The ASC absorbed management responsibility for the AEC, the JCSTC and its regional centres, and will include a Synthetic Environment Laboratory and Repository (SELR). With the stand-up of the ASC, the AEC and JCSTC will become the Experimentation and Training Divisions of the ASC respectively. The third element of the ASC will be the Support Division, which, along other responsibilities, will look after the SELR. The SELR will test and develop new and improved SE tools and will act as the Army SE repository where terrain databases and other common elements of Army SEs will be retained and developed.

Over time, the ASC will assume greater responsibility for the uniform delivery of all simulation facilities and M&S support to the Army at large, including tactical level weapons simulators. This initiative will require an increased partnership with industry and academia. With this approach, the Army will be positioned to prioritize and co-ordinate the effective provision of all M&S support to the Army and ensure that system technical, procedural and data integrity are maintained. Finally, the ASC will serve as the Army focal point for integration of Army based M&S support to CF led experimentation, combat development, training and operational activities.

Technology/Hardware

No information provided

Publications

No information provided

Contacts

No information provided

Electronic Links

http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/symp/cde/chap4-b5_e.asp

Military – Defence Research & Development Canada – Atlantic

Background

The mandate of Defence R&D Canada – Atlantic is to conduct research and development in the areas of Underwater Sensing and Countermeasures, Naval Command & Control Information Systems, Naval Platforms, Air Platforms, Signature Management, Emerging Materials, and Modelling & Simulation. These R&D activities support operations, acquisition, maintenance, and requirements planning by Canada's Navy and Air Force.

Technology/Hardware

Virtual Combat Systems

The Virtual Combat Systems group is developing the tools and framework (synthetic environments and simulators) required to examine future combat system concepts through virtual prototyping. A virtual maritime combat system has many potential applications. The operational effectiveness of sensors, signal-processing and data fusion techniques, command decision aids, and weapon systems may be demonstrated and refined. Platforms proposed for acquisition may be assessed for their operational utility. Integration requirements associated with new systems may be explored.

Virtual Maritime Environment

DRDC Atlantic's Virtual Maritime Environment is currently based upon the VMSA (Virtual Maritime Systems Architecture) distributed-simulation framework developed by Australia's Defence Science and Technology Organisation (DSTO) using High Level Architecture (HLA). This framework is the result of 4-5 years of experience and development by DSTO. Through The Technical Cooperation Program (TTCP) and a bilateral memorandum of understanding Canada has obtained a number of simulation components (federates). The helm federate includes an interface that allows the user to change the direction and/or the speed of the ship. The Virtual Maritime System Simulation Display (VMSSD) provides the user with a visual representation of the particular scenario.

The Virtual Combat Systems (VCS) group at DRDC Atlantic is now in the process of developing a Common Ocean Virtual Environment (COVE) federate. COVE will provide a common representation of the acoustic environment, and a Target Motion Analysis (TMA) simulation that will model the combat system functions related to the tracking of oncoming missiles, enemy ships or submarines, and other targets.

Ocean Sensing & Modeling

There are two main efforts in modeling: model development for research purposes, and support of the CF in providing advice on models and databases. The first area concentrates on reverberation and scattering models. Considerable effort has gone into using the models to extract environmental information from measured reverberation data. Continuing effort along these lines of "environmentally-adaptive" sonar is expected to be important for future sonars.

The VSHIP Visualizer

The VSHIP Visualizer has been developed by Defence R&D Canada – Atlantic (DRDC Atlantic) for the real-time visualization of ship motion and loads in waves. It is part of ongoing DRDC Atlantic work to develop capabilities to provide real time simulation of ship motion and structural response to realistic sea environments. This will give improved assessment of ship operability, stability, and structural strength. VSHIP can presently visualize ship response results generated by several computer programs. These include the ship motion and load prediction program SHIPMO developed at DRDC Atlantic, the program THAFTS

developed in the UK, and the 3D linear hydrodynamic code PRECAL developed through the Cooperative Research Ships (CRS) organization headed by Maritime Research Institute Netherlands (MARIN).

In VSHIP the user can change ship speed, ship heading (relative to the waves), wave height and wave spectrum or frequency, and immediately view changes in the seaway and the ship response. The program can combine regular wave predictions for a number of headings to provide visualization of ship response in a realistic seaway with directional wave spreading.

DRDC Atlantic has produced a software development methodology for code reuse called HOOD TK (Hierarchical Object Orientated Developers Toolkit). This toolkit encapsulates GUIs, graphics, databases, data management, and a reusable domain object library. For the VSHIP Visualizer development, HOOD technology was incorporated to make VSHIP a well-designed, integrated and extensible program application. Use of HOOD technology insures a common look and feel across all applications that are developed using HOOD as well as decreasing the amount of time needed to develop new applications.

EM Modelling

The UEMS Group is developing theoretical models to predict ELF electric propagation and scattering from conducting bodies such as mines, ships, and submarines in a conducting medium (seawater). The models will permit system performance and detection ranges to be estimated. Work has begun on the development of finite element (FE) and boundary element (BE) models of the SE and the SM signatures of Canadian ships. The FE method is used to predict the effect of degaussing current on reducing the magnetic signature of current vessels and to optimally design the degaussing coil system of future vessels. BE models are being developed to predict the magnitude of corrosion currents flowing around naval hulls, which give rise to the SE signature. The aim of BE modelling is to optimize the design of cathodic protection systems so that the SE signature is minimized while still maintaining adequate corrosion protection.

Total Mine Simulation System

To predict ship vulnerability to mine threats, the UEMS Group has collaborated with TTCP nations to develop, extend and maintain the complex Total Mine Simulation System (TMSS). TMSS software emulates ship signatures and the logic and algorithms of multi-influence mines. This emulation system is being used to provide mine vulnerability assessments for CF naval operations.

Underwater Vehicle Maneuverability

Ongoing work on the maneuvering behaviour of underwater vehicles is relevant to both manned submarines and unmanned underwater vehicles. A generic submarine maneuvering simulation code has been developed, and can model situations such as routine operations, ballast loss, and emergency maneuvers. Such a code can be used for development of submarine maneuvering limitation diagrams.

DRDC Atlantic has expertise in experimental and numerical analysis of underwater vehicle hydrodynamics. Computational fluid dynamics is routinely used to model flow around underwater vehicles. Recent experimental and numerical work has examined sternplane effectiveness, which significantly influences maneuvering performance of underwater vehicles.

Publications

A list of fact sheets can be accessed at:
http://www.atlantic.drdc-rddc.gc.ca/factsheets/factsheet-index_e.shtml

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http://www.atlantic.drdc-rddc.gc.ca/factsheets/06_operational_limits_e.shtml

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Electronic Links

http://www.atlantic.drdc-rddc.gc.ca/factsheets/20_VCS_e.shtml

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Military – Defence Research & Development Canada – Ottawa

Background

DRDC Ottawa is DND's authority and centre of expertise in Defence R&D Canada for radiofrequency communications, sensing and electronic warfare; network information operations; synthetic environments; and radiation effects.

Technology/Hardware

Joint Simulation Network (JSimNet)

The JSimNet incorporates individual simulations on both Linux (SeSU) and Windows-based systems; a file server that will support both Network File System (NFS) for multiple platforms and Common Internet File System (CIFS) for web-based applications; a Content Management server that will use the MS SharePoint Portal Server and, Simulation Servers that will use a variety of simulation models and tools software such as STRIVE, S2FOCUS and STK. HTTP and FTP protocols. The FFSENet design is based upon Gigabit Ethernet technology for connectivity between DRDC networks, peripherals and a high-grade firewall.

The JSimNet will be used to run and experiment with simulation execution environments, models, simulations, tools, utilities, data interchange standards, Simulation Object Models (SOM), Federation Object Models (FOM), and related functionalities using data such as database records, video streams, graphics using terrain and visual databases, data files, and selected e-mail messages. This environment will enable the development and testing of new concepts and ideas, the experimentation, checking, and testing of content transfers and real time simulations, network and system latencies, and the storing and retrieving of a pool of M&S datasets and simulation-related content.

Uninhabited Aerial Vehicle (UAV) Research Test Bed (RTB)

The UAV Research Test Bed consists of a ground control station and a synthetic environment that includes simulations of the UAV airframe (both fixed wing and vertical-take-off-and-land), sensors (electro-optical and infrared) as well as additional computer-generated forces and weather effects. The RTB uses off-the-shelf hardware and software. The RTB is modular and flexible, allowing integration of new sensor models and platform dynamics and can easily be employed as a federate in distributed simulations.

The UAV Research Test Bed supported the ALIX live experiment in Aug/Sept, 2004 in which a UAV flew missions over the east coast of Canada. The RTB will be used for mission rehearsal to verify aspects of the intended operations, mission timelines and networked information distribution. The RTB will also be used for a set of complementary synthetic experiments to test the sensitivity of the real experiment to changes in UAV platform and sensor capabilities.

Simulation and Modeling for Acquisition, Requirements, Rehearsal and Training (SMARRT)

Defence scientists from DRDC will be an integral part of the newly established Canadian Forces Experimentation Centre (CFEC) and Modeling and Simulation Co-ordination Office located at DRDC Ottawa. The SMARRT research activity will provide tools for Concept Development and Experimentation (CDE) and will combine with the Technology Demonstration Program (TDP) to provide concepts for experimentation. Modelling and simulation techniques are part of the research methodologies currently in use at all DRDC research centres. Under SMARRT, modeling and simulation will be integrated into the research programme to support CF requirements for concept formulation, equipment specification, test and evaluation, training, mission rehearsal and platform and weapon-system upgrading. M&S research initiatives at each lab will utilize current and developing research expertise and facilities.

Avionics Simulation

DREO demonstrated a leading edge simulation of the APG-65 Radar. The simulator, called SAPHIRE, provides a state-of-the-art synthetic environment for air-to-air combat. It can emulate the current fighter radar plus evoke significant enhancements developed in-house. DREO is currently upgrading SAPHIRE to demonstrate the effects of improving the radar memory and processor. The improved model will include a link to a CF-18 cockpit simulator at BAE Systems.

Tactical Aviation Mission System Simulation

Defence R&D Canada (DRDC), the Canadian Forces and defence-related industries were recently shown the future in Air Force acquisition technology. TAMSS, the Tactical Aviation Mission System Simulation Technology Demonstration Project (TDP), one of DRDC's first TDPs, was handed over to the Air Force for exploitation.

TAMSS demonstrated a virtual environment in which crews can determine requirements on a simulated battlefield, allowing helicopter pilots to test virtual modifications before implementing them. TAMSS combines technology with human-centred design to provide an advanced capability to support acquisition decisions. The use of a synthetic environment minimizes program risk and encourages new development. Patrice Belanger, Project Director of TAMSS, says "TAMSS will provide the means to demonstrate acquisition reforms through crew-in-the-loop distributed modeling and simulation."

Armoured Vehicle Test Bed

The AVTB allows development, demonstration, and evaluation of new fire control system (FCS) or other hardware or Operator-Machine Interface concepts in a controlled virtual environment. The aim of the AVTB is to make the hardware and crew believe they are on the battlefield by accurately reproducing FCS sensor inputs and sound, motion, and visual cues.

Computer-Generated Imagery Facility

The CGIF provides visual and infrared imagery to the crew for battlefield orientation and target engagement, to the FCS for automatic target detection and tracking and other essential FCS inputs, and to the host vehicle models for producing appropriate motion cues. It provides a complete range of terrain, from smooth highways to rough cross-country, and all weather conditions.

Vehicle and Sensor Models

All physical systems and sensors that would be found in a real vehicle are modeled, including their representative accuracy and errors. For the vehicle, models represent the gun and turret servomechanisms, gun barrel dynamics, internal and external ballistics, autoloader and firing mechanism, and hull dynamics. FCS sensor models include the weapon sights, laser range finder, turret angle encoder, meteorology sensors, ammunition temperature, position/orientation system, and muzzle reference system.

Crew Enclosure

A physical representation of the inside of an AFV turret is mounted on the motion platform. All internal equipment is mocked-up, and the interior can be completely re-configured to represent any type of vehicle. Also included is a high-fidelity sound system capable of reproducing all noises up to the 130 db gun firing.

Motion Platform

The hull dynamics model, with input from other models and the crew and driver, produces vehicle motion requirements. This motion is reproduced by a six degree-of-freedom electric platform, which is capable of producing greater accelerations than would be acceptable to the crew.

Performance Monitor

Performance data is recorded on the various components of the AVTB and FCS, including the time of all button presses and control movements by the crew. In addition, all sight outputs are recorded and date-stamped, and video cameras record each crewmember. This capability enables efficient crew debriefing, precise evaluation of the SMI aspects of ALFCS, and objective evaluation of FCS performance.

SBS SimLab: Space-Based Surveillance Simulation Laboratory

SBS SimLab is a powerful computer-based facility that models a Space-Based Surveillance (SBS) system and its operation, to evaluate its performance within an overall surveillance architecture. An advanced modular software simulation package, SBS SimLab can be installed as a stand-alone, or on a network of Sun SPARC stations.

Publications

The Defence Research Reports Database can be accessed at:
http://pubs.drdc-rddc.gc.ca/pubdocs/pcow1_e.html

Contacts

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Electronic Links

http://www.ottawa.drdc-rddc.gc.ca/publications/factsheets/smarrt_e.asp
http://www.ottawa.drdc-rddc.gc.ca/publications/factsheets/uav_e.asp
http://www.ottawa.drdc-rddc.gc.ca/publications/factsheets/jsimnet_e.asp

Military – Defence Research & Development Canada – Suffield

Background
DRDC Suffield activities include military engineering, mobility systems, weapons system evaluation and CB defence. Scientific and technological activities are supported by a full complement of services from meteorology, photography and field support, information services, facilities design and development, and materiel management.
Technology/Hardware
Hydraulic Test Bench
The Hydraulic Test Bench (HTB) is a general purpose tool built for the Vehicle Concepts Group at DRDC Suffield to analyze the performance of hydraulic systems and components. The HTB provides hydraulic flow, pressure, direction and the instrumentation to simulate a nearly unlimited number of hydraulic circuit configurations. It may also be used to operate other equipment.
The CMW is a graphical user interface developed for DRDC Suffield by SAIC (Science Applications International Corp.) which incorporates several computer models in a PC workstation environment for use in modeling and predicting various elements of vehicle mobility. These models include NRMM(US), TVPM, TANKDYN, SNOMOD (TREAD plus SNOTRAC) and GSIS.
Publications
No information provided
Contacts
No information provided
Electronic Links
http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/symp/cde/chap4-b5_e.asp

Military – Defence Research & Development Canada – Toronto

Background

DRDC Toronto is Canada's centre of expertise for defence research and development (R&D) in human protection and performance in extreme environments, human-systems integration, command effectiveness and behaviour, simulation and modelling and military operational medicine.

The DRDC Toronto mission is to enhance the effectiveness and ensure the health and safety of the human in any human-machine system or adverse environment.

Technology/Hardware

Noise Simulation and Modelling Facility

The quality of communications in many Canadian Forces (CF) environments is degraded by excessive noise. To optimize communications effectiveness, equipment such as headsets, respirators and communications links must be evaluated under realistic operational conditions. Communications modelling – using mannequins and test fixtures that simulate breathing, speech and hearing – provides a practical, safe and cost-effective alternative to on-site testing involving human subjects. The accurate simulation of high-noise environments, when integrated with communications modelling, provides a comprehensive facility for acoustical performance evaluations. DRDC Toronto's noise simulation chamber has been used since 1953 for a variety of noise exposure, hearing conservation and communications activities.

Noise Simulation Chamber: The noise simulation facility includes a spacious reverberant room (11 x 6 x 3m) for subjects and equipment, and a noise-shielded control room for experimenters. A library of 'military noises' is available to the user, and the chamber sound system is easily 'tuned' to accommodate new ones. Digital sound editing and numerical methods simplify the generation and presentation of test stimuli to subjects and the entry of response data into analysis routines. Dedicated monitoring and control systems promote subject safety. A recent upgrade permits the generation of infrasound that enables, for example, the faithful recreation of helicopter rotor noise.

Human Head Simulator (HHS): Developed for DRDC Toronto by the University of Toronto, the HHS is a breathing and voice simulation system coupled with a life-like headform. The voice system self-adapts to flow-restrictive equipment such as respirators. A recent upgrade permits the presentation of standard Diagnostic Rhyme Test speech lists to human listeners during the evaluation of communications links. The HHS may also be used with STIDAS (Speech Transmission Index Device using Artificial Signals), a computer-based system for the objective measurement of speech discrimination.

Binaural Auditory Simulator (BAS): The headform of this manikin is fitted with artificial ears that model the shape, texture and acoustical impedance of the human outer ear. The tympanic membranes are represented by microphones that allow the acoustical characteristics of a variety of hearing-protective or communications equipment to be assessed. The binaural 'listening' capability of the BAS also benefits three-dimensional audio research done at DRDC Toronto.

Team Decision-Making and C2 Facility

Canadian Forces (CF) operations frequently require personnel to work together while performing mentally demanding tasks under conditions of stress and uncertainty. Some tasks must be accomplished individually while others must be coordinated among team members to achieve maximum effect. Team members may work apart (i.e., distributed teams) and communicate through a medium (e.g., audio communication or computer network), or they may work in a common location (i.e., face-to-face teams). Team performance depends to a certain degree on individual-level performance; therefore, research into team decision-making

cannot happen in isolation from research into individual decision-making. The TDMC2 facility, completed in 1994, is used to investigate both individual and team performance in situations analogous to military C2.

Integrated Performance Modelling Environment (IPME): A human engineering tool used for mission, function and task analysis, IPME is the result of a collaborative development effort between the United Kingdom (DERA-CHS) and Canada (DRDC Toronto). IPME produces a simulated timeline of human/ machine activities and predicts operator workload and performance. It incorporates a human information processing model and is capable of interacting with other models and simulations.

LOCATE: A computer-based design aid for workspace layouts, used to model the effectiveness of human-machine communications in visual, auditory, tactile and movement domains.

Intelligent Clothing and Equipment Sizing System (ICESS): A camera-based, digital system for accurately determining clothing and equipment sizes for CF personnel. The system has great potential for reducing the costs of issuing clothing and equipment.

Aircraft Crewstation Demonstrator (ACD): A fixed-based, interactive simulator for analyzing cockpit technologies and crew interactions in fixed and rotary wing aircraft. It features an out-of-the-window display and uses rapid virtual prototyping technologies to simulate instrument panels. It was recently used to assess the efficacy of direct voice input for helicopter control.

Helicopter Deck-Landing Simulator (HDLS): This moving-base, interactive simulator demonstrates the exploitation of virtual reality and commercial off-the-shelf technologies to train demanding military tasks. It was developed to train Sea King helicopter pilots to land aboard a Canadian Patrol Frigate in difficult conditions.

Jet Ranger Simulator: This simulator demonstrates re-configurable use virtual reality and commercial-off-the-shelf technologies for simulating hazardous helicopter tasks. The simulator is be used to investigate the efficacy of these technologies for training autorotations.

Dismounted Infantry Simulator (DIS): This simulator employs a head-mounted display and sensors that track body movements and provides the means to examine the human interface to synthetic environments. It is being used to assess methods for training small teams to work together in a virtual environment, while the team members are physically separated by large distances.

Advanced Distributed Mission Training Technology Demonstration Project

The Canadian Air Force (CAF) will be relying on greater use of simulators in the future and is embracing the concepts of Distributed Mission Training (DMT) within synthetic environments to achieve their training objectives, including interoperability with allies. Defence R&D Canada (DRDC) has initiated the Advanced Distributed Mission Training (ADMT) Technology Demonstration (TD) project to help the CF achieve these goals.

The ADMT simulates a CF-18 and is, fully interoperable with the US and other allies, to address inter-simulator networking issues, visual display fidelity, the use of constructive agents for friendly and opposing forces and the right mix of simulator and in-flight training. Collaboration with the US is supported by a Technology Research and Development Program (TRDP) Project Arrangement that was signed in September 1999.

The prime objectives of the ADMT-TD project are to advance the development of flight simulator technologies and to investigate the use of flight simulators for training team, collective, joint and coalition tasks. The ADMT-TD project supports the CF's Advanced Distributed Combat Training System (ADCTS) project through an ongoing process of technology investigation and risk reduction activities. An additional

objective is to promote greater use of simulation and modelling for all elements of the Canadian Forces in equipment acquisition, operational analysis, training, mission planning and rehearsal.

Predictive Modelling

Canadian Forces personnel frequently operate in adverse environments that can be life-threatening to the unprepared individual and can impose an impediment to maximum performance. Prediction of human response in such environments is essential to both operational and contingency planning. Mathematical modelling provides a concise and cost-effective means to obtain such predictions. Modelling also enhances scientific understanding and provides a technical platform for rapid evaluation of various untested scenarios. At DRDC Toronto, modelling expertise has been developed for three specific environments:

- cold exposure (thermal);
- diving (hyperbaric); and
- airborne contamination (respiratory).

Dismounted Soldier Simulator

The Soldier Information Requirements Technology Demonstration project (SIREQ TD) is examining capability enhancements for the individual dismounted soldier in 2010-2015. For many of these capability enhancements, building prototypes for field trials would be too costly in time and money to be feasible. The Dismounted Soldier Simulator (DSS) was developed to allow SIREQ TD to investigate potential infantry soldier capability enhancements within a synthetic environment. The DSS can provide control of complex scenarios and comprehensive measurements without many of the costs and restrictions of field trials.

The DSS immerses an infantry section leader in a 3D computer-generated battlefield using a head-mounted visual display and motion tracking. This enables the soldier to accurately perceive spatial relationships among himself and the other soldiers and objects in the simulation. Proposed capability enhancements, such as future sensor systems, can then be added to the DSS and their effect on the section leader's comprehension, decisions, and actions in a variety of scenarios can be studied in great detail. The results of studies within the DSS can be used to identify tradeoffs between competing designs and to identify capability enhancements that should be advanced to field trials. The intent of the DSS is to allow experimentation on the impact of future systems on the section leader's spatial understanding of the battlefield; it is not suited to addressing all SIREQ TD questions or all infantry actions.

Maritime Surface/Subsurface Virtual Reality Simulator (MARS VRS)

A low-cost, portable simulator for teaching ship-handling skills to junior MARS officers. This simulator employed a head-mounted display to represent the bridge of a ship.

TOW Video Interactive Gunnery Simulator

A low-cost, portable simulator for training the operators of TOW missile systems. An earlier system, the Leopard C1 Video Interactive Gunnery Simulator, was also developed by DRDC Toronto.

Publications

The Defence Research Reports Database can be accessed at:
http://pubs.drdc-rddc.gc.ca/pubdocs/pcow1_e.html

An extensive list of fact sheets can be accessed at:
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/factsheet-index_e.html

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Head, Training Technology Group
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Human Protection and Performance Group
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SIREQ TD Simulation Lead
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http://www.toronto.drdc-rddc.gc.ca/about/about_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/f03_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/f08_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/f09_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/f11_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/a06_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/t06_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/t09_e.html
http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/t19_e.html

Military – Defence Research & Development Canada – Valcartier

Background

DRDC Valcartier improves Canada's defence capabilities by research and development, by providing independent expert advice and by investigating, demonstrating and exploiting innovative technological concepts for combat, electro-optical and command and control information systems.

Technology/Hardware

Aerodynamics

Valcartier scientists use Computational Fluid Dynamics to predict complex airflows around missile and projectile configurations (both in-service systems and novel concepts). The results contribute to the optimization of airframe/control configurations and improve the characterization of the overall flight dynamics.

Energetic Materials

By modelling the mixing process of solid ingredients, Valcartier scientists improve and optimize the processing and theological properties of polymer-based energetic materials. This approach results in munitions with effective delivery of energy on target.

Terminal Ballistics

Penetration mechanics and behind-armour effects studies are applied to the evaluation of complex high-velocity interactions between survivability enhancement systems and incoming projectiles. This expertise allows the evaluation of existing weapons and protection systems, and supports the definition and analysis of novel concepts.

Vulnerability and Lethality Analysis

The application of vulnerability and lethality assessment to the analysis of complex weapon effects and protection system effectiveness provides critical performance data. The scientists can then minimize the vulnerability or increase the lethality of equipment, optimize the platform systems, identify the performance parameters and support decision making.

Propulsion

Through a detailed study of the complex processes inside the combustion chamber of weapon propulsion systems, Valcartier scientists identify and evaluate the critical performance parameters. This advanced knowledge enables them to define novel concepts and perform trade-off analyses of advanced propulsion systems.

SLAMS

Survivability and Lethality Assessment Modelling Software

SLAMS is designed to study the lethality of weapons and the vulnerability of vehicle platforms (land, air, sea). It has the capability of direct-fire, indirect-fire and multi-hit attacks, of building complex scenarios with multiple targets, of studying the vulnerability of personnel (with or without body armour) and of analyzing the effects of behind-armour debris.

SLAMS offers a large catalog of materials to describe target-weapon scenarios. It is possible to build new targets directly (graphically) inside SLAMS or to import more complex geometries using a third party CAD/ CAM software. Several penetration algorithms are integrated into the software. These algorithms cover most cases of projectile versus target impacts. The analysis of the attack and the evaluation of the target

vulnerability and projectile lethality is performed through a series of damage algorithms for each component and through system logical diagrams.

CASE ATTI: A Test Bed for Sensor Data Fusion

Concept Analysis and Simulation Environment for Automatic Target Tracking and Identification is a highly modular, structured, and flexible test bed, developed as a proof-of-concept demonstrator to achieve the continuing exploration of multi-sensor data fusion.

Publications

A list of fact sheets can be accessed at:
http://www.valcartier.drdc-rddc.gc.ca/e/publications_e.asp?page=26&lang=e

Contacts

Defence R&D Canada – Valcartier

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http://www.valcartier.drdc-rddc.gc.ca/poolpdf/e/96_e.pdf
http://www.valcartier.drdc-rddc.gc.ca/poolpdf/e/170_e.pdf
http://www.valcartier.drdc-rddc.gc.ca/e/publications_e.asp?page=26&lang=e

Military – Joint Command and Staff Training Centre (JCSTC)

Background
The JCSTC provides constructive simulation support to the Army and is an integral component to how the Army will address the training domain. JCSTC has the capability to provide constructive simulation support to train commanders from section to formation level in all phases of war. The JCSTC uses several simulations, including Janus and the Command and Staff Trainer (CST).
Technology/Hardware
JANUS
A known capability, but no specific online resource available.
Command and Staff Trainer
A known capability, but no specific online resource available.
Publications
No information provided
Contacts
No information provided
Electronic Links
http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/symp/cde/chap4-b4_e.asp

Military – Weapons Effects Simulator (WES)

Background

WES is a live simulation system that will permit soldiers to accurately simulate their weapon fire with lasers and radio signals during force-on-force collective training exercises.

Technology/Hardware

The Weapon Effects Simulation system, commonly referred to as WES, is a live simulation system to be delivered as six separate suites. WES is comprised of the following sub-systems:

- Direct Fire Weapon Effects Simulators, or DFWES, include lasers mounted on all direct fire weapons such as rifles, machine guns and missiles, as well as laser detectors integrated onto soldier and vehicle players. Players are also equipped with miniature computers, radios, global positioning systems and power packs used to process, transmit and receive all engagement data. DFWES will also include the Observer Controller equipment that initializes player status and collects engagement data directly from players for field After Action Reviews. All suites will include DFWES.

- Area Weapon Effects Simulation, or AWES, is computer software generated, radio transmitted simulation of area weapon fire. Area weapons include artillery and mortars, minefields, and nuclear, biological and chemical events. Observer Controllers and the Exercise Control centre will transmit all AWES engagements. All suites will have AWES capability.

- Exercise Control, or EXCON, is a purpose-built control centre that will house all the people, hardware and software required to run WES exercises. It will include the computers, databases and software required to conduct Exercise Planning and Preparation (EPP), to monitor capture and record engagement data, and to prepare After Action Reviews (AAR) and Take Home Packages (THP). It will also include the Operator Analysts who will monitor each training exercise and highlight relevant lessons learned as they occur. Using the collected and highlighted engagement data, Army training officers will prepare AARs for the exercising units.

- Communication and Information System, or CIS, is a separate radio system used for the transmission of engagement data between the EXCON and the players in the field. Only the Wainwright suite will have a CIS.

- Contractor Conducted Logistics Support, or CCLS, is the integrated provision of all support and repair services to WES for a ten-year period following final delivery. All suites will include some form of CCLS.

Testing and delivery will start in 2004, with final deliveries complete by the end of 2005. The first full year of training with the Weapon Effects Simulation system will be 2006.

Publications

No publication provided

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Electronic Links

http://www.forces.gc.ca/admmat/dglepm/wes/main_e.html

Industry – Adacel Inc., Services Group

Background

Adacel provides airport virtual reality simulators and professional learning services. Their client list includes Nav Canada, the Canadian Forces, the United States Department of Defense, NASA, the Federal Aviation Administration and major educational institutions. Adacel Inc. is divided into 3 business units:

Simulation and Software Solutions – provide leading edge simulation and software services to the aviation community, including voice recognition, voice communication and visual modeling capabilities.

Professional Services – provides services that help customers maximize their simulation investment. ASG provides a complete suite of services ranging from consulting and learning to SimCenter/SimPartner programs and support services.

Air Traffic Management (ATM) Systems – development of operational systems that implement the Communications, Navigation, Surveillance / Air Traffic Management (CNS/ATM) concept. ATM's Aurora software was chosen to supply CNS/ATM automation for the FAA's Advanced Technologies and Oceanic Procedures (ATOP) program.

Technology/Hardware

Adacel has installations in over 30 countries, with systems being used in a variety of training and research and development roles. Their simulation systems use commercial off the shelf hardware to reduce acquisition and support costs. MaxSim Tower and MaxSim Radar are capable of integrated tower and radar operations. MaxSim Tower and MaxSim Radar have the flexibility to be operated in standalone configurations, or in multiple independent scenarios.

The Aviation Research and Training Tools product series includes ARTT Tower, ARTT Radar, ARTT Driver and ARTT Coms, to provide low acquisition costs and reduced operation and support costs. MaxSim VCS is a scalable, multi-channel voice communication system that enables simultaneous radio, telephone, intercommunications, public address and alarms through an intuitive and user configurable touch screen interface. MaxSim VCS can be installed as a standalone voice communications system or with other MaxSim products to provide an integrated training environment. MaxSim VCS includes the capability to record voice communications on all channels. MaxSim Speech is the latest development of Adacel's voice recognition and speech synthesis capabilities. MaxSim Speech includes synthetic voices.

Publications

White Papers can be accessed at: http://www.adacelinc.com/products/simulation/whitepapers.html

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Electronic Links

http://www.adacelinc.com/index.php

Industry – AEgis Simulation Technologies, Inc.

Background

AEgis Simulation Technologies, Inc. is a Canadian subsidiary of The AEgis Technologies Group Inc., and offers products and services for many simulation applications. AEgis applies expertise in the following areas:

- Simulation Based Business Practice – SEBA, SBA, SMARRT
- Simulation and Software Development
- Simulation Integration – HLA/DIS technologies
- Simulation Studies and Analysis
- Training Simulator Development
- Verification, Validation and Accreditation (VV&A)
- Simulation Training – HLA, SEDRIS, and VV&A

AEgis was awarded a Standing Offer to support the Synthetic Environment Co-ordination Office (SECO) of the Canadian Forces and Department of National Defence.

Technology/Hardware

AEgis Simulation provides engineering and consulting services for modeling and simulation, including expertise in High Level Architecture (HLA); object-oriented analysis and design; simulation and software development; training simulators; simulation integration; distributed simulation; simulation technologies; concept modeling; systems engineering; verification, validation, and accreditation programs for software and simulations; and systems analysis.

A technologies overview can be accessed at: http://www.aegissim.ca/AEgisSimulation_Technologies.html.

AEgis Simulation supplies COTS modelling and simulation software products to companies around the world in industries such as aerospace, automotive, biomedical, electronics, defence, petrochemical, power generation, and process control. More information can be accessed at: http://www.aegissim.ca/AEgisSimulation_Software.html.

AEgis Simulation provides a variety of hardware interfaces for simulation -based training. AEgis delivers turn-key simulation training systems that are based upon low cost COTS. More information can be accessed at: http://www.aegissim.ca/AEgisSimulation_Hardware.html.

Publications

Press Releases can be accessed at: http://www.aegissim.ca/AEgisSimulation_News.html

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Electronic Links

http://www.aegissim.ca/AEgisSimulation_aboutUs.html

Industry – Amixima Corp.

Background
AMIXIMA provides experience in visualization and virtual reality to help businesses express their ideas with 3d animations and special effects.
Technology/Hardware
Advanced Visualisation / Virtual Reality
AMIXIMA has eight years of experience in the field of visualization technologies for use in wide variety of applications including manufacturing, medicine, architecture, construction, forensics, education, web design, data analysis, and marketing.
Publications
No publications provided
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Electronic Links
http://www.amixima.com/

Industry – Arius3D

Background
Arius3D provides tools and expertise to create high resolution, digital models of real world objects. The company's technology allows colour and shape capture at the same time, unaffected by the object's ambient lighting conditions. Arius3D's customers are from universities, museums, industry, and entertainment companies.
Technology/Hardware
The company has secured a worldwide, exclusive license to commercialize state-of-the-art, three-dimensional, colour, laser imaging technology from the National Research Council of Canada (NRC). The technology is patented by the Government of Canada and Arius3D Inc. Colour and geometric shape are collected at the same time for perfect registration. The detailed images can be compressed without loss of definition and represented in a variety of formats for use in a wide variety of applications including research and analysis, education, marketing, entertainment, conservation, replication and design.
Publications
Media news can be accessed at: http://www.arius3d.com/index.html
Contacts
Arius3D 755 The Queensway East Unit #20 Mississauga, Ontario L4Y 4C5 CANADA
Electronic Links
http://www.arius3d.com/index.html

Industry – Atlantis Systems International

Background

Atlantis Systems International is supplies simulation and training systems for the international defence market and commercial aviation industry. The company produces computer-based desktop systems, aircrew training devices, and simulation-based maintenance trainers, which have always been part of Atlantis' business.

Atlantis has integrated virtual aircraft technology with high-fidelity aircraft hardware and simulated test equipment for aircraft maintenance training. Customers include the Royal Australian Air Force, the Canadian Forces and the US navy. Flight training solutions include cockpit procedures trainers, operational flight trainers, maintenance trainers and the HVT, a re-configurable virtual reality-based simulator for training high-precision tasks such as deck landings in all-weather conditions, long-line and mountain operations. Originally developed by Defence R&D Canada, Atlantis Systems International continues development of the system, and is licensed to markets the simulation world-wide.

Atlantis developed a simulation-based Automated Pilot Selection System (APSS) for the Canadian Department of National Defence to help screen pilot candidates as well as training simulators for a wide variety of military and commercial aircraft.

Technology/Hardware

Helicopter Cockpit Procedures Trainer

Atlantis makes cockpit procedure trainers to reduce the use of full flight simulators and operational flight trainers for teaching procedures.

Helicopter Virtual Trainer

Although this device was initially designed to teach of helicopter deck landing skills, the VR approach allows reconfiguration for training a wide range of military and civilian helicopter operations.

Publications

Brochures can be accessed at: http://www.atlantissi.com/brochures

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Electronic Links

http://www.atlantissi.com/

Industry – Barco

Background
Barco develops and sells a wide range of visual projection technologies and display media, such as project screens.
The company's products are used for a wide variety of visual simulations including use in air traffic control, defence & security, medical imaging, flight and ship bridge simulations.
Technology/Hardware
Barco offers visualization solutions, including display technology for large, multiple screens, for use in a wide variety of applications for simulation and entertainment. The company's headquarters are in Belgium.
Publications
Press Releases can be accessed at: http://www.barco.com/corporate/en/pressreleases/default.asp
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http://www.barco.com/

Industry – CAE

Background
CAE is a leading provider of simulators and integrated training solutions for civil and military customers. The company has hundreds of simulators installed worldwide for air, maritime and land training, including simulations for power plants. It also offers a range of simulation equipment and modelling and simulation software.
Technology/Hardware
The company offers a full range of products for all types of military platforms, including full mission simulators, weapon systems trainers, deployable trainers, part task trainers, and maintenance trainers.
It also produces enabling technologies, such as state-of-the-art image generators and multi-spectrum spatial data bases, and simulation and modeling tools.
More products and services can be accessed at: http://www.cae.com/www2004/Products_and_Services/index.shtml
Publications
The News Room can be accessed at: http://www.cae.com/www2004/News_Room/index.shtml
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Electronic Links
http://www.cae.com/www2004/index.shtml

Industry – CMC Electronics

Background
CMC Electronics designs, manufactures, sells and supports high-technology electronics products for the aviation, infrared sensing, global positioning and space electronics markets.
Technology/Hardware
CMC provides human factors capability and produced modular aircrew cockpit demonstrators for DND Canada. The systems were used for human system integration experimentation and for demonstrations of distributed networking. The company also developed an Enhanced Vision System (EVS) to increase flight crew situational awareness by helping them see through fog, haze, rain and at night. The system uses infrared (IR) and millimeter wave radar (MMWR) sensor systems.
Commercial Aviation
http://www.cmcelectronics.ca/En/Prodserv/Commav/commav_intro_en.html
Military Aviation
http://www.cmcelectronics.ca/En/Prodserv/Milav/milav_intro_en.html
Publications
Press Releases and CMC News can be accessed at: http://www.cmcelectronics.ca/En/News/press_release_index_main_en.html
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http://www.cmcelectronics.ca/En/index_en.html

Industry – CMLabs

Background
CMLabs provides technology and consulting services for visual simulation, including physics-based modeling of interactive 3D dynamics and geometry. The company's expertise includes fast fluid dynamics, deformable bodies and human character animation for use in animation, human factors engineering, virtual-reality, robotics, and engineering design.
Technology/Hardware
CMLabs provides a dynamics engine that applies the fundamental properties of Newtonian physics to 3D simulations that allow applications developers to build physically accurate motion models for real-time interactive simulations.
One of their products is a full-featured particle system geared to virtual reality applications in the simulation industry.
Publications
Press Releases can be accessed at: http://www.cm-labs.com/news/press.php
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Industry – CyberWorld, Inc.

Background
CyberWorld, Inc. sells virtual reality technologies and turn-key, custom solutions.
Technology/Hardware
CyberWorld Inc., provides the following technologies: • Controllers – http://www.cwonline.com/store/view_category.asp?Category=13   • Headmounted Displays – http://www.cwonline.com/store/view_category.asp?Category=15   • Stereoscopic Products – http://www.cwonline.com/store/view_category.asp?Category=14
Publications
Press Releases can be accessed at: http://www.cwonline.com/about/pressroom.asp
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Electronic Links   http://www.cwonline.com/

Industry – Digital Image FX

Background
DIFX uses virtual reality technologies as enablers for telehealth.

Technology/Hardware
DIFX develops software utilizing the latest in VR technology and specializes in stereoscopic imaging, spatial 3D sound and telecommunication applications for medicine, education and industry.

Publications
No publications provided

Contacts

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Wayne Bell

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Electronic Links
http://www.digital-fx.ca/index.html

Industry – eNGENUITY Technologies

(founded in 1985 as: Virtual Prototypes Inc.)

Background eNGENUITY Technologies Inc. develops, sells and supports software for the development of simulation-based, visual designs, i.e., human-machine interfaces, and other simulation applications.
Technology/Hardware The company produces a software tool suite for rapid prototyping, designing, testing, and deploying human-machine interfaces, e.g., the development of dynamic, interactive, real-time graphical representations of the displays and controls found in the cockpit of an aircraft. eNGENUITY also provides a framework for software developers to build more complex and complete simulation-based training systems, including the means to construct scenarios, and to model the dynamics of fixed and rotary wing aircraft.
Publications Case Studies can be accessed at: http://www.engenuitytech.com/Case_Studies/index.shtml White Papers can be accessed at: http://www.engenuitytech.com/resources/index.shtml
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Electronic Links http://www.engenuitytech.com/

Industry – **Fakespace Systems**

Background

Fakespace develops and sells a wide variety of visual display systems that can be used for collaborative engineering, design, research, and entertainment applications. The company provides advanced visualization systems and integrated solutions.

Technology/Hardware

Fakespace provides a variety of large scale, visual projection displays for stereoscopic or monoscopic observation. The displays can be room sized or portable, as well as scaleable, and reconfigurable. Tracking technology is employed to correct point of view during movement.

Publications

Success Stories can be accessed at: http://www.fakespace.com/successes1.shtml

Press Releases can be accessed at: http://www.fakespace.com/press1.shtml

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Electronic Links

http://www.electrohome.com/fakespace.htm

http://www.fakespace.com/main1.shtml

Industry – Fats Canada Inc.

Background
FATS Canada Inc. sells training simulators, including devices for simulating small arms, air defence, and armoured vehicles. The company strives to produce training devices that have the look and feel of an actual weapon system.
Technology/Hardware
FATS training systems are based on commercial off the shelf (COTS) components. The company's products include several simulators used by the Canadian Forces, including training devices for the Eryx, TOW, Cougar, Javelin and Light Armoured Vehicle.
Publications
No information provided
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http://www.simtran.ca

Industry – General Dynamics Canada

Background
General Dynamics Canada is an international supplier of military software and hardware for land, air and maritime systems. They can provide completely integrated command, control and communication systems.
Technology/Hardware
General Dynamics Canada provides expertise and solutions for digital voice and data distribution, acoustic signal processing, tactical displays, multi-sensor scanning, ballistics, surveillance, and fire control. General Dynamics Canada and Canada's Department of National Defence have jointly funded simulation-based acquisitions projects including an advanced land fire control system and a future, armoured fighting vehicle.
These are further outlined at: http://www.gdcanada.com/products/index.html
Publications
News Releases can be accessed at: http://www.gdcanada.com/company_info/post.asp?type=News
Articles can be accessed at: http://www.gdcanada.com/company_info/post.asp?type=Articles
Contacts
Ottawa
3785 Richmond Road Ottawa, Ontario K2H 5B7 CANADA Tel: (613) 596-7000 Fax: (613) 820-5081 E-mail: info@gdcanada.com
Electronic Links
http://www.gdcanada.com/company_info/index.html

Industry – Greenley & Associates Inc. – Simulation and Visualisation Centre

Background
Greenley & Associates (G&A) is a consulting services provider that offers clients expertise in the core service areas of project management, human factors, modelling and simulation, and business analysis and usability.
Technology/Hardware
Greenley & Associates employs immersive visualization technology to support system design, system evaluation, requirements analysis, training transfer analysis, and operational decision support. In 2005, a virtual command centre will be established at the G&A centre in Ottawa to aid evaluation of alternative command centre layouts and organizations.
Publications
No information provided
Contacts
Mike Greenley (President/CEO), M.Sc., PMP   Principal Consultant   Tel: (613) 247-0342 ext. 201   Fax: (613) 225-4281   E-mail: mike@greenley.ca
Electronic Links
www.greenley.ca

Industry – The HFE Group

Background

The HFE Group provides expertise in modeling and simulation, human factors engineering, training and user-interface design. The HFE Group is a user, developer, and reseller of software tools that support human-centered design of systems and trainers.

Technology/Hardware

The HFE Group is a developer of High Level Architecture (HLA) and DIS-based distributed simulation applications.

The company applies expertise in the integration of commercial off-the-shelf technologies and the development of physical models to provide simulation devices can be used for a variety of applications, including training, mission planning, and simulation based acquisition.

Publications

No publications provided

Contacts

Ottawa

220 Laurier Avenue West
Suite 350
Ottawa, Ontario K1P 5Z9
CANADA
Tel: (613) 230-8226
Fax: (613) 230-5088
Information: nadinewellwood@thehfegroup.com

Electronic Links

http://www.thehfegroup.com

Industry – I-mmersion

Background

I-mmersion creates social or communal cyberspaces to represent parallel worlds for education, entertainment and simulation. The company provides solutions for connecting many users to a common, shared, virtual environment.

Technology/Hardware

An example of I-mmersion's social software is Virtual Canada. This is a 3D massively multi-player environment where thousands of people can log in as avatars and explore the regions of Canada. I-mmersion combines creativity with technology to create communal, virtual spaces.

Publications

Success Stories can be accessed at: http://www.imm-studios.com/index2.htm

Contacts

Immersion Studios

Exhibition Place
Music Building
285 Manitoba Drive
Toronto, Ontario M6K 3C3
CANADA
Tel: (416) 260-7711
Fax: (416) 260-7495

General Inquiries

E-mail: info@imm-studios.com

Sales Inquiries

E-mail: sales@imm-studios.com

Electronic Links

http://www.imm-studios.com/index2.htm

Industry – InSpeck Inc.

Background
InSpeck manufactures, produces and sells 3D scanning hardware and software that makes use of optical technology to capture forms, including human shape.
Technology/Hardware
InSpeck specializes in digitizing shapes, in particular, human form, for medical application, animation, multi-media and entertainment markets.
The company possesses expertise in both hardware and software.
Publications
Press Releases can be accessed at: http://www.inspeck.com/press/releases/releases.asp
Media Coverage can be accessed at: http://www.inspeck.com/press/coverage/coverage.asp

Contacts

Head Office
3530 St-Laurent Blvd
Suite 303
Montréal, Québec H2X 2V1
CANADA
Tel: (514) 284-1101
Fax: (514) 284-1108

Product Development Center

2014 Jean-Talon North
Suite 190
Ste-Foy, Québec G1N 4N6
CANADA
Tel.: (418) 682-6161
Fax: (418) 682-3884

General Information

E-mail: info@inspeck.com

Product & Corporate Information

Tel: (514) 284-1101
E-mail: sales@inspeck.com

Electronic Links

http://www.inspeck.com/contact/contact.asp

Industry – The Learning Edge Corp.

Background
The Learning Edge Corporation specializes in knowledge management and delivery solutions for corporate and institutional clients.
Technology/Hardware
The company brings emerging technologies to the business and education/entertainment environments. They provide expertise, technology, and production resources needed to develop custom courseware, web-enabled products or virtual environments. Focus areas include intelligent agents and collaborative learning environments.
Publications
Case Studies can be accessed at: http://www.theledge.com/cases.htm
Contacts
The Learning Edge Corporation 90 Claremont Street Toronto, Ontario M6J 2M5 CANADA Tel: (416) 248-0667 E-mail: tle@theledge.com
Electronic Links
http://www.theledge.com/

Industry – Lockheed Martin Canada

Background

Lockheed Martin Canada engages research, design, manufacture, and integration of advanced-technology products for the global market. The company is a leader in systems integration, software development and large-scale program management.

Technology/Hardware

Lockheed Martin supplies electronic defence and surveillance systems to Canada. The company's capabilities include the integration and management of complex computer-based electronic systems; the design, manufacture and supply of military-standard computers, electronic warfare, sonar and security systems; and the provision of life cycle support for major platforms.

Lockheed Martin provides a variety of training and simulation technologies, including live, virtual and construction simulations for defence and civil customers. Their products include training support and devices and for air, land and maritime environments.

More information about these the company can be accessed at:
http://www.lockheedmartin.com/wms/findPage.do?dsp=fec&ci=12981&sc=400

Publications

Press Releases can be accessed at: http://www.lockheedmartin.com/wms/findPage.do?dsp=fnec&ti=111

Contacts

Lockheed Martin Canada
3001 Solandt Road
Kanata, Ontario K2K 2M8
CANADA
Tel: (613) 599-3270
Fax: (613) 599-3282

Electronic Links

http://www.lockheedmartin.com/wms/findPage.do?dsp=fec&ci=14848&rsbci=9&fti=124&ti=0&sc=400

Industry – MacDonald Dettwiler and Associates Ltd.

Background
MacDonald, Dettwiler and Associates Ltd. provides solutions for gathering and processing large amounts of data to improve decision making and performance. Their customers include government and business.
Technology/Hardware
MacDonald, Dettwiler and Associates Ltd. generates and collects property information and provides geospatial services for use in urban planning, crop management, and defence, among other possible applications.
Publications
MDA News can be accessed at: http://www.mda.ca/news/index.html
Contacts
MacDonald, Dettwiler and Associates Ltd.   13800 Commerce Parkway   Richmond, British Columbia V6V 2J3   CANADA   Tel: (604) 278-3411   Fax: (604) 273-9830   E-mail: invest@mda.ca   or, for general inquiries, info@mda.ca
Electronic Links
http://www.mda.ca/

Industry – Manitoba Virtual Reality Centre

Background
The Virtual Reality Centre is a joint effort of the Government of Canada and the Province of Manitoba. The goal of the centre is to provide industry, academia, and government opportunity to explore and exploit virtual reality technology.
Technology/Hardware
The Virtual Reality Centre contains advanced visualization tools that allow display of complex data sets for use in manufacturing, civil engineering, architecture, urban planning, product design, science, entertainment, and medicine. The facility allows for collaborative design; up to twenty users can participate at a time.
Publications
Virtual Reality Centre News can be accessed at: http://www.virtualrealitycentre.ca/news.html
Contacts
Address
Unit 12-1329 Niakwa Road E.   Winnipeg, Manitoba R2J 3T4   CANADA   Tel: (204) 945-6000 / 1-800-728-7933   Fax: (204) 945-1784   E-mail: info@virtualrealitycentre.ca
Electronic Links
http://www.virtualrealitycentre.ca

Industry – NRC Institute for Information Technology

Background
The Institute for Information Technology is part of the National Research Council of Canada. The Institute participates in R&D collaborations and partnerships in information and telecommunications technologies with business, universities and government agencies, in Canada and around the world.
Technology/Hardware
The Institute for Information Technology conducts scientific research, develops technology, creates knowledge and supports innovation to benefit Canadian society. The R&D program and technology transfer activities includes innovation of enabling technologies for access to 3D information of the real world. The topics include real-world data capture for representation, visualization, collaboration in virtual environments and data mining.
Publications
The publication list can be accessed at: http://iit-iti.nrc-cnrc.gc.ca/iit-publications-iti/2004_e.html
Contacts
NRC IIT Staff List
http://iit-iti.nrc-cnrc.gc.ca/iit-personnel-iti/iit-personnel-iti_e.html
Electronic Links
http://iit-iti.nrc-cnrc.gc.ca/index_e.html

Industry – NRC Virtual Environment Technology Centre

Background

The Virtual Environment Technology Centre (VETC) is part of the Integrated Manufacturing and Technologies Institute of the National Research Council of Canada. The VETC was created to assist the exploitation of virtual environments by Canadian industry.

Technology/Hardware

The Virtual Environment Technology Centre provides access to the latest technologies and know-how for simulation based design and other VE applications. Its equipment includes a variety of immersion visual display systems for individuals and groups. The facilities include an immersive theatre and design workspaces. The VETC collaborates with academic and industrial partners.

Publications

Publications can be accessed at: http://imti-itfi.nrc-cnrc.gc.ca/publns_e.html

Contacts

Integrated Manufacturing Technologies Institute

National Research Council Canada
800 Collip Circle
London, Ontario N6G 4X8
CANADA

Ellie Withers, VETC Co-ordinator
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E-mail: ellie.withers@nrc.gc.ca

IMTI Technology Management
Tel: (519) 430-7092
Fax: (519) 430-7064
E-mail: marketing.imti@nrc.gc.ca

Electronic Links

http://imti-itfi.nrc-cnrc.gc.ca/vetc_e.html

Industry – SAFEWORK Inc. Human Modeling Technology

Background
SAFEWORK Inc. provides tools and expertise for static and dynamic anthropometric engineering.
Technology/Hardware
The company provides human modeling capabilities and expertise for accurate, detailed investigation of human system interactions. The company's products include virtual environments for visualizing the interaction between a human form and its workspace from multiple perspectives, including immersive views.
Publications
Press Releases can be accessed at: http://www.safework.com/news/news.html
Contacts
General Information
E-mail: info@safework.com
Electronic Links
http://www.safework.com/safework_pro/features.html

Industry – Tactical Technologies Inc.

Background
Tactical Technologies Inc. provides simulations for electronic warfare, and engineering expertise.
Technology/Hardware
Tactical Technologies Inc. focuses on the methods and tools for simulations of radar, electronic warfare and infrared sensing and countermeasures.
Tactical Technologies Inc. offers electronic combat software simulations for surface-to-air, air-to-air, anti-ship missile, and anti-aircraft applications.
More information can be accessed at: http://www.tti.on.ca
Publications
Technical papers can be accessed at: http://www.tti.on.ca
Contacts
Tactical Technologies Incorporated
356 Woodroffe Avenue 2nd Floor Ottawa, Ontario K2A 3V6 CANADA Tel: (613) 828-0775 Fax: (613) 828-8310 E-mail: info@tti.on.ca
Electronic Links
http://www.tti.on.ca

Industry – Thales Systems Canada

Background
Thales Systems Canada provides command, control, and communications (C3) systems integration.
Technology/Hardware
The business of the company includes mission systems and sensors, communications, and C4ISR systems. The company's expertise includes integration of radar, electro-optic, navigation and C3 systems, as well as the design and development of real-time software and integrated logistics support for civilian and military applications. Further information can be accessed at: http://www.thales-systems.ca/products/products.htm
Publications
Projects and Case Studies can be accessed at: http://www.thales-systems.ca/projects/projects_page.htm
Contacts **Ken Bowering** Director Business Development Tel: (613) 723-7000 ext. 202 Fax: (613) 723-5600 E-mail: ken.bowering@ca.thalesgroup.com **Don Bolduc** Human Resources Manager Tel: (613) 723-7000 ext. 208 Fax: (613) 723-5600 E-mail: don.bolduc@ca.thalesgroup.com
Electronic Links http://www.thales-systems.ca

Industry – Vivid Group Inc.

Background
Vivid Group Inc. provides the means to capture body motion for interaction with virtual environments.
Technology/Hardware
Vivid Group Inc. uses video-based technology to capture human motions for animation and interaction with the virtual environments. Additional sensors or other input devices are not needed.
Publications
Press Releases can be accessed at: http://www.vividgroup.com/press.html
Contacts
Vivid Group
317 Adelaide Street West   Suite 302   Toronto, Ontario M5V 1P9   CANADA   Tel: (416) 340-9290 / (800) 315-1189   Fax: (416) 348-9809   E-mail: info@vividgroup.com
Vincent John Vincent
Tel: (416) 340-9290 ext. 222
Kelley Howard
Tel: (416) 340-9290 ext. 231
Electronic Links
http://www.vividgroup.com

Academic – Bell Canada University Labs

Background

Bell Canada and the University of Toronto are cooperating in the research and development of a virtual environment that will allow collaboration among geographically distributed team members. The goal of the project is to build an effective collaborative environmental infrastructure.

Technology/Hardware

The researchers come from computer science, industrial and mechanical engineering, psychology, and sociology. The virtual environment allows teams of different sizes to perform a wide range of tasks.

Publications

The project announces that it will in the future make a library of resources available to the public via the web address below.

Contacts

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Project Manager
BUL – Collaborative Environment Project

Faculty of Information Studies
140 St. George Street
University of Toronto
Toronto, Ontario M5S 3G6
CANADA
Tel: (416) 978-5762
Fax: (416) 978-3234
E-mail: quanhaas@fis.utoronto.ca

Electronic Links

http://www.bul.mie.utoronto.ca/index.html

Academic – Carleton University – Aviation and Cognitive Engineering (ACE) Lab

Background
The Aviation and Cognitive Engineering Laboratory (ACE) is part of the Center for Applied Cognitive Research at Carleton University, in Ottawa. The goal of the ACE laboratory is to discover and apply fundamental principles of human perception and cognition to research and design for aviation.
Technology/Hardware
The staff conducts fundamental research on human perception and cognition to enhance the understanding of fundamental processes and applies knowledge of perception and cognition to the design and evaluation of human-machine systems.
The laboratory participates in the Tactical Aviation Mission System Simulation (TAMSS) technology demonstration project of Defence R&D Canada by developing qualitative and quantitative measures and models of situational awareness.
The Canadian Foundation for Innovation (CFI) has recently provided funds to establish a center for Advanced Studies in Visualization and Simulation (V-SIM). The initiative includes partners from the simulation industry, including CAE Inc.
Publications
Recent publications and presentations can be accessed at: http://www.carleton.ca/ace/publications.html
Contacts
ACE Lab
430 Azirelli Pavilion Tel: (613) 520-2600 ext. 2496 Fax: (613) 520-2539
Dr. Chris Herdman
Director Professor of Psychology and Cognitive Science Director, Aviation and Cognitive Engineering Lab Centre for Applied Cognitive Research Carleton University Tel: (613) 520-2600 ext. 8122 E-mail: Chris_Herdman@carleton.ca
Electronic Links
http://www.carleton.ca/ace/index.html

Academic – eyeTap Personal Imaging

Background
Formerly known as the Humanistic Intelligence Laboratory (HI Lab), EyeTap Personal Imaging Lab (ePI Lab), at the University of Toronto, focuses on computer vision and intelligent image processing.
Technology/Hardware
The technology and hardware support the research of wearable computing and cybernetic concepts, including mediated reality. The laboratory explores technology and use of personal imaging as the key enabling technology for augmented/mediated reality and wearable computing.
Publications
Publications can be accessed at: http://www.eyetap.org/publications/index.html
Contacts
University of Toronto   10 Kings College Road   Room 2001   Mailroom S.F. B540   Toronto, Ontario M5S 3G4   CANADA   Tel: (416) 946-3387   Fax: (416) 971-2326   E-mail: epilab@eyetap.org
Electronic Links
http://www.eyetap.org/about_us/hilab/index.html

Academic – McGill University Center for Intelligent Machines

Background
The goal of the Centre for Intelligent Machines (CIM) is to advance the state of knowledge in robotics, automation, artificial intelligence, computer vision, voice recognition, systems and control theory. About fourteen laboratories are included in the center.
Technology/Hardware
The Shared Reality Laboratory of the Centre for Intelligent Machines is advancing the means for communicating high-fidelity data among distributed users. The researchers are investigating how context-sensitive technology can facilitate both human-computer and computer-mediated human-human interaction. A shared-reality research facility, connected by low-latency transport of high-fidelity audio and video over advanced computers networks, is being used to provide physically distributed participants with a strong sense of co-presence.
The researchers in the Haptics Laboratory design and engineer software and hardware components for haptic interfaces, e.g., in the construction of surgical simulators. A variety of haptic devices have been created.
Publications
Publications are accessible via the links to each laboratory from the home page of the centre.
Contacts
A complete list of the center's staff members can be accessed at: http://www.cim.mcgill.ca/
Electronic Links
http://www.cim.mcgill.ca/

Academic – Queen's University – Touch Laboratory

Background

The researchers of the Touch Laboratory at Queen's University study the sense of touch in humans. Their work includes how the sighted and blind use haptic exploration and manipulation, and they study haptic interfaces for teleoperation and virtual environments.

Technology/Hardware

The research of the Touch Laboratory includes the study of haptic perception and inter-sensory integration, through direct and indirect contact with familiar and unfamiliar objects. It includes behavioural measures and the design of sensors for autonomous robots.

Behavioural measures typically involve psychophysical responses, the classification of videotaped hand movements that accompany manual exploration during haptic search, response latencies, errors, oral/written questionnaire responses, and kinematic and dynamic measures of hand/arm movements.

Publications

A list of publications can be accessed at: http://pavlov.psyc.queensu.ca/~cheryl/reprints.html

Contacts

Dr. Susan Lederman

Director of Laboratory
Department of Psychology
Touch Laboratory
Room 327, Humphrey Hall
Queen's University
Kingston, Ontario K7L 3N6
CANADA
Tel: (613) 533-6607
E-mail: lederman@psyc.queensu.ca

Electronic Links

http://psyc.queensu.ca/~cheryl/labpage.html

Academic – Queen's University – Visual and Auditory Neurosciences Laboratory

Background
The Visual and Auditory Neurosciences Laboratory of Queen's University studies the processing of visual and auditory information, by animals and humans. The virtual reality group applies knowledge of multi-sensory perceptual mechanisms to the advancement of virtual and artificial perceptual environments.
Technology/Hardware
The focus of the virtual reality group, of the visual and auditory neurosciences laboratory, is the study of motion, including the distinctions between perceptions of self motion and object motion, and the perceptual differentiation of objects through motion cues. The researchers have built several VR platforms, including systems that make use of a head-mounted display and a treadmill or bicycle as the interface for travel within virtual environments that simulate large spaces, e.g., for architectural and design purposes.
Publications
Recent publications can be accessed at: http://pavlov.psyc.queensu.ca/%7Efrostlab/vr.html
Contacts
Dr. Barrie Frost Professor. Visual and Auditory Neuroscience, Virtual Reality Department of Psychology Queen's University at Kingston Kingston, Ontario K7L 3N6 CANADA Tel: (613) 533-2484 / 2485 (lab) Fax: (613) 533-2499 E-mail: frost@psyc.queensu.ca
Electronic Links
http://pavlov.psyc.queensu.ca/%7Efrostlab/index.html

Academic – Ryerson University –
Virtual Environment Laboratory (VEL)

Background
The Geomatics and Virtual Environment Laboratory of Ryerson University was established to advance the integration of geo-spatial, modeling, visualization and virtual reality technologies for use in urban environment applications. The applications include land use management, 3D urban modeling, landscape mapping, disaster management, transportation planning, and informal settlement management.
Technology/Hardware
The researchers of the Geomatics and Virtual Environment Laboratory are now working on satellite remote sensing of the urban environment and web-based, environmental visualization. The topics of study include the development of algorithms for image analysis, software for extraction of man-made objects (e.g., buildings and roads) and the generation of digital elevation models from multi-spectral, remote imagery.
Publications
Publications can be accessed at http://www.geomaticseng.ryerson.ca/vel/Publication.htm
Contacts
Dr. Jonathan Li, P.Eng, OLS   Director, Virtual Environment Lab   Department of Civil Engineering   Ryerson University   Tel: (416) 979-5000 ext. 469   Fax: (416) 979-5122   E-mail: junli@ryerson.ca   **Yu Li**   Assistant Director   Department of Civil Engineering   Ryerson University   E-mail: y6li@ryerson.ca
Electronic Links
http://www.geomaticseng.ryerson.ca/vel/default.htm

Academic – Schlumberger iCentre

Background
The Schlumberger iCentre is part of the Calgary Centre for Innovative Technology (CCIT), University of Calgary. It provides visualization facilities, scientific computation, and interactive conferencing for academic researchers and industry clients.
Technology/Hardware
The Schlumberger iCentre is a multi-disciplinary laboratory that provides large-format, immersive 3d displays to enable collaborative work and visual presentation. The center is used for studies of biomechanics, environmental impact, resource development, infrastructure renewal, and product development.
A list technologies is available at http://www.ccit.com/index.php?option=content&task=view&id=186
Publications
Faculty publications can be accessed at: http://www.ccit.com/index.php?option=content&task=view&id=131&Itemid=150
Contacts
The Calgary Centre for Innovative Technology University of Calgary 2500 University Drive NW Calgary, Alberta T2N 1N4 CANADA Tel: (403) 210-9768 Fax: (403) 210-9770 E-mail: ccit@ucalgary.ca
Electronic Links
http://www.ccit.com/index.php?option=content&task=view&id=113

Academic – Sheridan College – Visualisation Design Institute (VDI)

Background
The Visual Design Institute (VDI) of Sheridan College in Oakville, Ontario, has an Interactive Virtual Environment Laboratory that finds ways to extract meaningful information from databases using real-time, interactive, three dimensional visual displays.
Technology/Hardware
No information provided
Publications
No information provided
Contacts
For information on the VDI, contact: avrim@acm.org
Electronic Links
http://www.sheridaninstitute.ca/info/ord/vdi.html

Academic – Simon Fraser University – School of Interactive Arts and Technology

Background
The School of Interactive Art and Technology at Simon Fraser University includes the Interactive Visualization Laboratory, (iVizLab) and the Shared Virtual Environment Laboratory. The iVizLab pursues socially based, interactive visualizations to enhance communication, collaboration and learning and the Shared Virtual Environment Laboratory pursues immersive virtual reality.
Technology/Hardware
The iVizLab is using 3D facial animation to understand the non-verbal communications of the human face and body. The applications include human interfaces to computers, web and other communication systems. The researchers are also making use of avatars, AI and character-based agents to advance social communication and telepresence. The Shared Virtual Environment Laboratory is exploring multi-sensory cuing, including vision, sound and tactile senses for immersion and shared virtual environments, including representation by avatars.
Publications
Publications for the iVizlab can be accessed at: http://ivizlab.sfu.ca/publications.php
No publications link is available for the Shared Virtual Environment Laboratory.
Contacts
Steve DiPaola
Directory Associate Professor School of Interactive Arts & Technology Faculty of Applied Sciences Simon Fraser University Tel: (604) 268-7479 Fax : (604) 268-7488 E-mail: sdipaola@sfu.ca
An extensive list of the research staff can be accessed at: http://www.sfu.ca/~siat/research/archives/000237.html
Electronic Links
http://ivizlab.sfu.ca/about.php
http://www.sfu.ca/~siat/research/archives/cat_research.html

Academic – University of Alberta –
Department of Computer Science

Background
The Department of Computer Science at the University of Alberta includes The Man Machine Interface Laboratory and Computer Graphics Research Group. The goals of the Man Machine Interface laboratory include research in new man-machine interfaces, the development of human centered automation systems, the development of systems for complex and dynamic environments and exploration of basic cognitive process in man-machine interfaces. The Computer Graphics Research Group addresses image based rendering, texture analysis and synthesis, animation, and shadowing and geometric modeling.

Technology/Hardware
The Man Machine Interface laboratory includes a CAVE-like environment with large format projection and a portable EEG/VR system. The research projects include the exploration and advancement of realism in VR, intuitive systems, visualization of data, and high speed networking. The Computer Graphics Research Group developed the MR toolkit, a very early set of software tools for the production of virtual reality systems and other forms of 3D user interfaces. The main author, Dr. Mark Green, has moved to the City University of Hong Kong.

Publications
Publications are provided for each staff member at: http://www.cs.ualberta.ca/ammi/

Contacts
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University of Alberta
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CANADA
Tel: (780) 492-3114
Fax: (780) 492-1061
E-mail: wfb@ualberta.ca

Electronic Links
http://www.cs.ualberta.ca/ammi/

Academic – University of British Columbia

Background

The University of British Columbia contains the Imager Laboratory for Graphics, Visualization and HCI within the Department of Computer Science. The goal of this laboratory is to advance the science of computer graphics, computer animation, human computer interaction, visualization and computational geometry. The Faculty of Graduate studies includes the Media and Graphics Interdisciplinary Centre (MAGIC). It is linked to other departments and faculties and explores computer graphics, animation, human-computer interaction, and multimedia.

Technology/Hardware

A wide range of expertise is available on topics related to human computer interaction and media, however, the specific laboratory resources are not identified on web.

Publications

Publications can be accessed at: http://www.cs.ubc.ca/nest/imager/imager.html

Contacts

Contact information can be accessed at: http://www.cs.ubc.ca/nest/imager/imager-web/People/people.html

Electronic Links

http://www.cs.ubc.ca/nest/imager/imager.html

http://www.cs.ubc.ca/nest/magic/home

http://www.cs.ubc.ca/nest/magic/projects/hands/home

Academic – University of Calgary – Computer Science Department

Background
The Department of Computer Science of the University of Calgary contains the laboratory for Human Computer Interaction (HCI) and Computer Supported Cooperative Work (CSCW). The HCI activities include investigation of the way people invoke computer actions and navigate hypertext structures such as the World Wide Web. The CSCW helps support geographically distributed small teams for collaboration.
Technology/Hardware
A complete list of projects can be accessed at: http://grouplab.cpsc.ucalgary.ca/projects/
Publications
Publications can be accessed at: http://grouplab.cpsc.ucalgary.ca/papers/index.html
Contacts
Dr. Saul Greenberg   Human-Computer Interaction & Computer Supported Cooperative Work   Department of Computer Science   University of Calgary   Calgary, Alberta T2N 1N4   CANADA   Tel: (403) 220-6087   Fax: (403) 284-4707   E-mail: saul@cpsc.ucalgary.ca
Electronic Links
http://grouplab.cpsc.ucalgary.ca/index.html

Academic – University of Laurentian –
Virtual Reality Laboratory

Background
The Mining Innovation, Rehabilitation and Applied Research Corporation (MIRARCO) is located in Sudbury Ontario, Canada's largest industrial mining centre. Its Virtual Research Laboratory allows multidisciplinary teams to visualize complex datasets. MIRARCO results from a collaboration between Laurentian University and the private and public sectors. They promote mining innovation and provide a bridge between researchers and industry.
Technology/Hardware
The Virtual Reality Laboratory provides a high-resolution stereo projection on a 22' x 8' spherical screen. An earth modeling software package is used to transform the complex mathematical data into 3D visual images. The VRL can also be used for different applications including engineering, architecture, environmental monitoring, urban planning, equipment design, and medicine.
Publications
Selected publications can be accessed at: http://www.mirarco.org/publications.php#selectedpublications
Contacts
MIRARCO – Mining Innovation Laurentian University Willet Green Miller Centre 933 Ramsey Lake Road Sudbury, Ontario P3E 6B5 CANADA http://www.mirarco.org/staff.php
Electronic Links
http://www.mirarco.org/aboutvr.php http://www.mirarco.org/facilities.php

Academic – University of Ottawa

Background
The University of Ottawa houses the Distributed & Collaborative Virtual Environments Research Laboratory (DISCOVER) within the School of Information Technology and Engineering (SITE).
Technology/Hardware
Two major applications have developed. These include Virtual e-commerce and Industrial Training. The current research topics of DISCOVER include telehaptics, distributed and collaborative virtual environments, intelligent sensor networks, ubiquitous computing and intelligent agents. More project information can be accessed at: http://www.discover.uottawa.ca/. The facilities include high-end image generators and a long screen that can fold to form a CAVE-like environment.
Publications
A publications list can be accessed at: http://www.discover.uottawa.ca/
Contacts
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Electronic Links
http://www.discover.uottawa.ca/

Academic – University of Québec in Outaouais (UQO) – Cyberpsychology Lab

Background
The Cyberpsychology Laboratory is a research centre of the University of Quebec in Outaouais (UQO) and the Pierre-Janet Hospital. The researchers study underlying psychological processes, clinical effectiveness and applied applications in psychology.
Technology/Hardware
The research of the center involves virtual reality and the implementation of psychological intervention by videoconference. The studies assess the effectiveness of videoconferencing and virtual reality in the treatment of disorders, such as agoraphobia.
Publications
Publications can be accessed at: http://www.uqo.ca/cyberpsy/labo_en.htm#publi
Contacts
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http://www.uqo.ca/cyberpsy/cyber_en.htm#def

Academic – University of Toronto – Ergonomics in Teleoperation and Control Laboratory (ETC Lab)

Background

The Ergonomics in Teleoperation and Control Laboratory is part of the Department of Mechanical and Industrial Engineering at the University of Toronto. The laboratory conducts research in the human factors and ergonomics of telerobotics, stereoscopic displays, virtual reality, and augmented reality.

Technology/Hardware

The laboratory created an augmented reality system that makes use of graphical overlay and stereoscopic viewing and a system for virtual telerobotic control.

Publications

Publications are listed at: http://etclab.mie.utoronto.ca/ETC-Bibliography.html

Contacts

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Electronic Links

http://vered.rose.toronto.edu/

Academic – University of Waterloo

Background
The Computer Graphics Laboratory of the University of Waterloo conducts research in curve and surface design, rendering, colour imaging, and user interfaces.

Technology/Hardware
Links to software packages being developed by the members of the Computer Graphics Laboratory can be accessed at: http://www.cgl.uwaterloo.ca/Software/

Publications
No information provided

Contacts
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Electronic Links
http://www.cgl.uwaterloo.ca