

# **Project Planning Report for the Centre for Collaborative Interactive Digital Media**

Campus and Facilities Planning

December 16, 2009

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## I. EXECUTIVE SUMMARY

The Department of Computer Science proposes the creation of a new Centre for Collaborative Interactive Digital Media (CCIDM) within the Bahen Centre for Information Technology that will combine the activities of existing laboratories, including the Dynamic Graphics Project (dgp), the Knowledge Media Design Institute (KMDI), and various computer systems research groups. The goal of the project is to create an internationally renowned interactive digital media centre to facilitate collaborative research and production through a collective of computer scientists, engineers, scholars and artists.

The proposed CCIDM has recently received funding from the Canadian Foundation for Innovation (CFI) and Ontario Research Fund (ORF). This funding will allow for creation of new space (infill) and renovation of existing space to accommodate the CCIDM's activities and personnel, as well as the purchasing of new equipment for its research initiatives.

The variety of laboratories and research spaces of the CCIDM requires approximately 890 NASM. The strategy for accommodating the CCIDM at the Bahen Centre involves renovation of approximately 845 gross square metres (GSM) of existing fifth floor space (mainly dgp and Systems laboratory space); and the creation of approximately 210 NASM (290 GSM) of new space on the fifth and fourth floors by infilling two new floors within the current three-storey volume of Room 3200. Room 3200 is a Department of Computer Science study space known as the "Great Hall of Computing". This proposal generates an overall net increase of Department of Computer Science space of 155 NASM.

The renovated, new and flexible lab space of the CCIDM will house updated data capture, usability and prototyping facilities and accommodate a distributed usability experimentation and observation space; a reconfigurable sensor-rich 'active' room; and a media production and collaboration room.

The construction of the proposed project will occur in two phases. The first phase, the structural infill of the two floor levels, will commence in May 2010 with a projected occupancy by December 2010. The second phase, the interior renovation, will begin in May 2011 with occupancy by December 2011. Work on the project has already begun with the advanced hiring of a structural engineer to begin consultation regarding the infill.

Short term secondary effects of the project include the loss of use of room 3200 during Phase 1 construction, as well as disruptions to the rooms on the two floors below (classrooms 1200, 1210, 1220). Temporary staging space for research activities (dgp and Systems groups) displaced during construction will be required. Long term secondary effects include the loss of some natural light to existing fourth and fifth floor rooms fronting onto room 3200, as well as a need to create new computer server room space.

Additional electricity costs to supply work stations in the CCIDM are estimated at \$29,024 per annum. Operating costs in the Bahen Centre are charged at a rate equivalent to \$64.93/GSM or \$18,830 for this space. With some additional cooling costs, the total costs (electricity, operation and maintenance) for the CCIDM space are estimated to be approximately \$51,000 per annum.

The estimated Total Project Cost for the renovation and construction portion of the project is \$3,187,000. Funding sources for the construction of the project include \$ 2,987,000 from the CFI/ORF grant award and a contribution from the Faculty of Arts & Science of \$200,000.

## II. PROJECT BACKGROUND

### a. Membership

Eugene Fiume (Chair) Principal Investigator, Professor, Department of Computer Science

Chris Sparks, Chief Administrative Officer, Department of Computer Science

Eran Henig, undergraduate student, Department of Computer Science

Adrienne De Francesco, Assistant Dean & Director, Office of Infrastructure Planning, Faculty of Arts & Science

Bruce Dodds, Director, Utilities & Building Operations, Facilities & Services

Christian Lessig, PhD student, Dynamic Graphics Project, Department of Computer Science

Julian Binks, Director, Planning & Estimating, Capital projects, Real Estate Operations

Alan Webb (Secretary) Planning Officer, Campus & Facilities Planning

### b. Terms of Reference

1. Make recommendations for a detailed space program and functional layout to accommodate the proposed Centre for Collaborative Interactive Digital Media.
2. Demonstrate that the proposed space program will take into account the Council of Ontario Universities' (COU) space standards and University's own best practice guidelines for research space.
3. Determine the secondary effects of the project, including any necessary space reallocation, and the impact on the delivery of academic programs and activities in the building during construction.
4. Review the capacity of existing site services and infrastructure at the Bahen Centre for Information Technology and determine the extent of upgrades, if required.
5. Identify all existing equipment and moveable furnishings to be relocated and reused, and new equipment and moveable furnishings necessary to the project and their related costs.
6. Identify all data and communications requirements and their related costs.
7. Identify a phasing plan and implementation plan for the project, if required.
8. Identify all security and occupational health and safety requirements and their related costs.
9. Determine a total project cost (TPC) estimate for the capital project, including costs associated with secondary effects.
10. Identify all sources of funding for the capital project and increased operating costs once the project is complete.
11. Report by January 2010.

### **c. Background Information**

Digital media, which was once the exclusive domain of interactive computer graphics and imaging, has blossomed into a ubiquitous medium for self expression and communication. It touches many sub-disciplines of computer science, engineering, the social sciences and humanities. The new Centre for Collaborative Interactive Digital Media (CCIDM) that is to be established by the Department of Computer Science will bring the historic successes of existing laboratories such as the Dynamic Graphics Project (dgp) and the Knowledge Media Design Institute (KMDI), together with computer systems and interactive content creation, into a university-wide initiative in digital media. The goal of the project is to create an internationally renowned interactive digital media centre to facilitate collaborative research and production through the congregation of computer scientists, engineers, scholars and artists.

The proposed Centre has recently received funding from the Canadian Foundation for Innovation (CFI) and Ontario Research Fund (ORF) to create and renovate new space to accommodate the Centre's activities and personnel as well as the purchasing of new equipment for its research initiatives.

Capital and renovation work for the project is to take place in the Bahen Centre for Information Technology. New space (approximately 290 GSM) will be created by building an in-fill section of two floors within the three-storey tall volume of the "Great Hall of Computing". The Great Hall space was conceived as a volume that could accommodate future in-fill floors above; this initiative presents an opportunity to take advantage of the available space. The existing dgp, KMDI and Systems laboratories on the fifth floor of the Bahen Centre will be upgraded and renovated to create an open, integrated digital media hub. The new and renovated lab space will house updated data capture, usability and prototyping facilities, accommodating a distributed usability experimentation and observation space, a reconfigurable sensor-rich 'active' room, and a media production and collaboration room.

The estimated Total Project Cost for the renovation and construction portion of the project is \$3,187,000.

### **d. Statement of Academic Plan**

The rapid introduction of new forms of digital media can obscure the fact that there are many deep and diverse intellectual questions that underlie it. What makes digital media effective? What aspects of the world can be visually modelled? What makes an image, animation or virtual environment sufficiently realistic? Is digital media necessary or merely effective? Why are there so many more consumers of digital media than consumers of physical media, and how can we make it easier for humans to express themselves through it? What new tools are needed to produce and consume digital media? How can natural language understanding, smart rooms, computer vision, speech synthesis and artificial intelligence contribute to create more satisfying virtual environments? What are the limits of this entire endeavour? What social factors does it affect?

Venturing to answer this range of questions requires a mixture of many research areas. As such, the Centre will house researchers in human-computer interaction, computer graphics, visual measurement, machine learning, computer-supported cooperative work, telepresence, networked gaming, mobile computing, speech processing, psychology and social work with systematic, human-centric multimedia data collection and processing.

With applications-level, interaction techniques-level, as well as systems-level research for creating and sharing digital media, the Centre's research has the potential for a widespread impact on the way people interact with technology in the future and to place the University of Toronto's Department of Computer Science at the core of these developments.

## **e. Space Requirements**

### **Overview of Existing Space**

The Department of Computer Science (DCS) has a total of 7,773 NASM of space distributed across four buildings on the St. George campus: 242 in the Gerstein Science Information Centre, 1,085 in the D.L. Pratt Building, 1,929 in the Sandford Fleming Building, and 4,517 in the Bahen Centre for Information Technology.

The existing areas of the *dgp* and Systems groups on the fifth floor of the Bahen Centre that will be renovated or directly altered for the CCIDM project total 734.3 NASM and the new infill floors represent an addition of 155 NASM.

An overall space analysis of the Faculty of Arts & Science is currently underway. This will identify how Department of Computer Science (and CCIDM) space compares to COU guidelines, which will inform future space planning.

### **Occupant Profile**

The proposed occupants of the new CCIDM come from a combination of programs within the Department of Computer Science: primarily the Dynamic Graphics Project and the Computer Systems and Networks Group, with some participation from members of the Knowledge Media Design Institute (KMDI). KMDI space on the seventh floor of Bahen is not affected by this project.

As this project creates new research space and does not result in a net increase in faculty, staff or student complements except through possible natural growth, accommodation of additional occupants is not required. Renovated spaces must be reconfigured in order to separate lab functions from graduate student offices, which are currently cohabiting within open research space. Furthermore, an important goal will be to allow relatively unencumbered movement among lab participants throughout the facility.

For reference, the overall Department of Computer Science profile is included below with the CCIDM occupant profile for core and other projected users:

<b>Department of Computer Science Profile</b>	<b>Current DCS 2009/10</b>	<b>CCIDM Core Group (within DCS)</b>	<b>Other Users of CCIDM</b>
FTE Academic	58.3	12.0	
FTE Research Associates	0.0	0.0	
FTE Postdoctoral Fellows	16.0	1.0	
FTE Non-Academic Staff			
FTE Admin Staff – Not Requiring Offices - Clin/Tch			
FTE Admin Staff Requiring Offices	34.9	1.0	0.0
Subtotal FTE Admin Staff	34.9	1.0	0.0
Visiting Researchers			15.0
FTE Undergraduate Students	540.0	0.0	10.0
FTE Graduate Students			
FTE Doctoral - PHD	170.0	43.0	25.0
FTE Masters- MSc	101.0	25.0	7.0
Total FTE Students	811.0	68.0	42.0

For further reference, see below a summary of current DCS space and total areas following construction of the CCIDM. Note that there will be a net increase of 155 NASM created by the project:

<b>Department of Computer Science Category of Space</b>	<b>Existing Area (NASM)</b>	<b>Proposed CCIDM area increase</b>
Teaching Labs & Support	1,163.0	0.0
Research Facilities	1,587.7	26.5
Faculty Offices & PdF offices	1,465.5	0.0
Graduate Student Spaces	1,526.6	122.0
Non-Academic Staff Offices	531.4	0.0
Departmental Support Space/Lounge	1,150.1	6.0
<b>Subtotal- Dept COU Categories</b>	<b>7,424.3</b>	<b>154.5</b>
Undergraduate Study Space	195.8	0.0
Student Club/Lounge Space	153.1	0.0
<b>Subtotal- Add'l Dept Requirements</b>	<b>348.9</b>	<b>0.0</b>
<b>Total DCS Nasm</b>	<b>7,773.2</b>	<b>7,927.7</b>

The Existing Space Inventory in Appendix 1 provides additional information.

### III. PROJECT DESCRIPTION

#### a. Vision Statement

Humans have a deep need to communicate. Digital media represents the most recent and perhaps pervasive tool for communication ever created. It facilitates and enhances social connectivity; digital content can be endlessly copied, manipulated, and communicated, it promotes self-expression, and it is constantly hybridized and transformed to suit the needs of its users. The combination and integration of digital media is part of the next wave of applications that will affect our quality of life, health and the environment. The use of interactive digital media is ubiquitous in modern life, including entertainment, design, art, medicine, science and engineering.

The term *convergence* has been applied to both analogue and digital media virtually since their inception. Even with the usurping of analogue media by digital forms, the term persists and has at least two meanings. One refers to the synthesis of traditionally distinct forms of media into a hybrid; an example of this would be the fusion of newspapers, video, and sound into a web-based presentation vehicle. The other is the synthesis of different groups of people performing traditionally disparate media-related functions into an exciting hybrid; an example here would be the creation of collaborative partnerships among artists, composers, animators, game developers, scientists and engineers -- or self-organized collaborations emerging from social networks -- to define new directions for digital media, and new kinds of interactive digital content. Our vision deals with both forms of convergence, but with an emphasis on the second.

Interactive media labs have a forty year history; some lessons and requirements are clearly drawn from experience:

- It is important to have a scientific agenda that is both systems- and content-oriented. Development of new forms of digital communication will drive the need for new kinds of content, which demand new kinds of research.
- Any agenda involving interactive digital media must be inherently human-centered, and thus requires the participation of researchers in human-computer interaction (HCI), artificial intelligence (AI), psychology and neuroscience.
- Digital media is about enhancing communication, and as such, scientific research in digital media must be complemented by collaboration with "content creators" such as artists, authors, film-makers, animators, sculptors, musicians and dancers.
- It is difficult to do research in, and creation of, digital media in an entirely distributed fashion. A flexible lab combining the above agendas must be constructed to permit direct, face-to-face collaboration among people from various backgrounds.
- The increasingly impromptu mode of digital media composition and distribution, together with the advent of statistical methods and data-driven approaches at all levels of supporting technology, requires a strong focus on ecologically valid content sampling, archiving, analysis and visualization.
- The notion of "closed" laboratories conflicts with the open nature of collaboration, and as such the design any new centre requires a more open design allowing researchers to wander and serendipitously collaborate.

The recent proliferation of digital content and the emergence of new modes of expressions (from twitters to blogs to mash-ups to video clips), present new challenges and opportunities for the dissemination, retrieval and use of content that transcends traditional media.

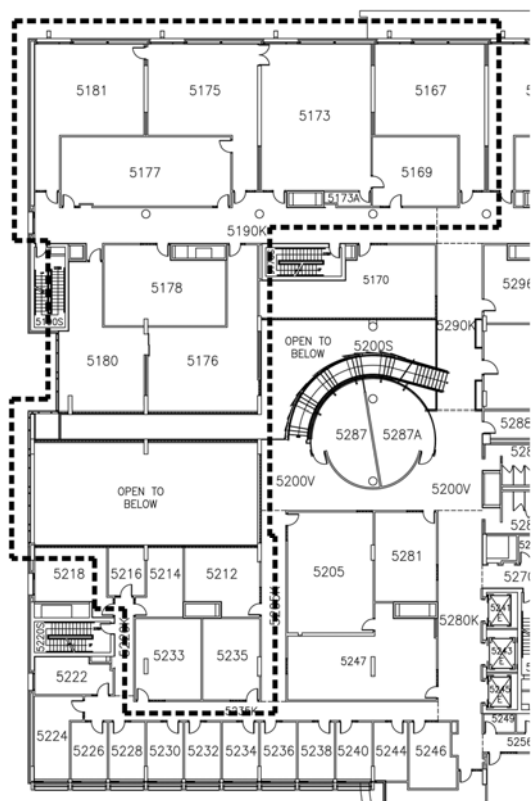


Current means for effective sampling, distribution and access, search, indexing, summarization, visualization and manipulation of content have not kept up with the shift in volume, ubiquity, and variety of digital content. This limits the ability to take full advantage of convergence under either definition. Research into these problems typically draws from researchers in networking, mobile computing, speech and natural language processing, vision, machine learning, visualization, HCI, knowledge media design and information systems. However, there is a pressing need for research on distribution and usage of digital media informed by research into its production, and vice versa.

The project's vision is to create an interactive digital media centre of the highest international standards to conduct the research mentioned above. This is entirely feasible given the collective scientific expertise of the DCS's team of researchers. The proposed approach leverages the historic success of existing laboratories such as the Dynamic Graphics Project (dgp) laboratory and the Knowledge Media Design Institute (KMDI) into a university-wide initiative in digital media.

## b. Space Program and Functional Plan

The strategy for accommodating the CCIDM at the Bahen Centre involves renovation of approximately 845 GSM of existing fifth floor space (mainly dgp and Systems laboratory space); and the creation of approximately 210 NASM (290 GSM) of new space on the fifth and fourth floors by infilling two new floors within the current three-storey volume of Room 3200. Room 3200 is a DCS study space known as the "Great Hall of Computing" with 25 study stations (184 NASM). This proposal generates an overall net increase of Department of Computer Science space of 155 NASM.



Left: Partial plan of Bahen 5<sup>th</sup> Floor showing extent of CCIDM area.

Above: View looking east within Bahen room 3200, the Great Hall of Computing. This room will receive two infilled floor levels and is the area indicated "Open to Below" on 5<sup>th</sup> Floor plan (at left).

Beyond the basic needs outlined in the project's original CFI grant application, which included additional space to adequately accommodate research activities and associated graduate students, there is a functional requirement to have laboratories that are configured to better serve the rapidly changing nature of the technologies under investigation.

The dgp and Systems laboratory space (rooms 5167 through 5181) will be fully renovated and the graduate student, PDF and technical support offices to the south of the infill (rooms 5212 through 5235) will likely remain as-is save for some functional improvements by way of new doors. This latter group of rooms will continue to serve their function of office space following completion of the project.

In addition to the creation of an interdisciplinary, collaborative research media hub, the program and spatial organization proposed for the CCIDM is expected to lend both functionality and efficiency to its area in the Bahen Centre. The key infrastructural move of the CCIDM is the infilling of two floor areas (on the fourth and fifth floor levels) within the void above room 3200. By creating an additional 290 GSM of floor area, the necessary CCIDM program is free to be organized in the most functional manner appropriate to its activities.

One of the most effective changes brought about by the new CCIDM will be the separation of graduate research activities from research laboratory space. Currently, these two primary occupancies share space, hindering the flexibility of the laboratory space for research and fostering less than optimal conditions for many graduate students.

In order for the CCIDM to work as an integrated centre, a direct horizontal connection is required between the renovated areas and the new, infill area as well as a direct vertical stair connection between the new fourth and fifth floor infill areas. Another central need is for natural light to be provided, as much as possible, into the graduate student research rooms. Lastly, a main entry door into the new CCIDM area would provide a clear presence and delineation within the Bahen Centre. The location of such an entry would have to be reviewed relative to building code requirements regarding access to exit stairs.

A detailed space program (to be read in conjunction with the functional plans) is listed as follows:

#### Large Display Active Room

This room will be used as a testbed for researching a variety of ubiquitous computing scenarios, as well as new interface styles for emerging display technologies. Common ubiquitous computing applications involve a confederation of devices cooperatively sensing environmental and user contexts. In this space, three raw sensing systems are required: a UbiSense system, a Vicon system, and load sensors.

The UbiSense provides indoor localization down to 30 cm precision and allows us to explore location-based services. The Vicon allows the highly accurate capture of motion and will act as the primary mechanism for capturing user input when interacting with the various display technologies. This system allows investigation of gesture-based interfaces, as well as other novel forms of interaction. The collection of load sensors provides information describing the amount of force exerted by the user towards the ground. This information enables detecting events, such as when someone is walking, dancing, or even falls, in the space. This context allows for ubiquitous computing applications to adapt themselves to different situations and provide users with useful services while they are performing their daily activities.

Additionally, cameras are required for recording user activity within the space. The captured digital media can be reviewed later or it can be processed by computer vision systems to uncover additional context not provided by the UbiSense system, the Vicon system, and the collection of load sensors.

Finally, various display technologies will be used to explore how users may interact with digital media. Large wall displays, tabletop display surfaces, and small portable devices afford different interaction styles; thus, these devices allow for the research of novel ways of interacting with digital media. Because of the large number of devices often involved in a ubiquitous computing environment, a dedicated space outfitted with a variety of devices is required to minimize the cost involved with constructing and deconstructing temporary research spaces.

A reconfigurable room will enable the sharing of the underlying instrumentation across multiple projects in a spatially divisible manner as projects evolve over time. While components of such an active room are available at various laboratories worldwide (e.g., UBC and University of Washington have motion capture labs; Georgia Tech has an “aware home” that explores aspects of this research in the home context), the Department of Computer Science is not aware of a similar facility worldwide that integrates all these components in a single coherent space.

### Usability Lab

Another key component of the CCIDM infrastructure is the creation of a multi-floor usability experimentation/observation space. These rooms will permit the study of usability in both formal and “real world” settings. In one part of this space, the usability lab will be incorporated into a room for the study of multimedia conferencing: a large open-concept office for work on digital audio and video processing, collaboration technology for health and medicine, and gaming research.

Much of the data gathered will be organic, coming out of working groups using real technology. Other data will be collected in a more formal manner, with researchers observing participants from behind glass. In either case, the behavior of the study participants will be captured using cameras and microphones, then analyzed by researchers. Cost savings will be achieved by creating one distributed lab as opposed to two individual ones.

The University of Toronto has at least three usability labs: in the Faculty of Information, within the Department of Psychology, and the University Health Network (UHN). These labs each vary in size and capability. While suitable for the research in which these groups are engaged, none satisfy the Department’s needs. The other labs are focused solely on formal research in extremely controlled spaces, meaning that none are designed to capture and study the real-life use of technology envisaged.

Because the Centre’s research will involve work on mobile devices and group interaction, the space must be large enough to allow several people to move around and interact. Studies will occasionally require continuous use of a space for upwards of a month. Such demands cannot be met at UHN. Finally, none of the existing usability labs has the advanced data capture and processing technology upon which our research hinges.

### Seminar, Collaborative Research, and Media Production Rooms

Digital media content generation involves interaction amongst groups of people with varied skills, including engineers, artists, and animators. To better facilitate the work of such a diverse group of people, an appropriate space where the groups can come together to work on projects (e.g., a production such as the recent Academy Award winning film “Ryan” involving Landreth and Singh) is required.

This space should also be able to support collaboration with geographically distributed team members. In addition to supporting the media production process, we also wish to study the processes by which such teams collaborate, with the goal of developing better tools to aid such collaboration. This production and collaboration room thus needs to be appropriately instrumented with production-level local and remote audio/video capture, playback, and conferencing equipment.

### Image Acquisition Research Room & Prototyping Workshop

Researchers working on the capture and synthesis of digital imagery and models require access to equipment for capturing and processing various characteristics of the physical world, using equipment such as 3D scanners and microscopes. This equipment will reside in a room dedicated to physical data capture, and will include ancillary gear such as optical benches and high-end cameras.

Similarly, much research in human-computer interaction requires the building of prototype devices for which a small workshop style prototyping space with 3D printers, laser cutters, and small machine tools is required.

### Graduate Student Research Rooms

Graduate students from the various disciplines working in the centre will have desks distributed across various parts of the space. In particular, the KMDI researchers are spread across campus while the dgp and Systems researchers are in separate labs. By grouping these researchers together we strengthen collaboration between these groups.

The research rooms can serve as a testing ground for technologies developed at the CCIDM. The goal is to make the space as configurable as possible; research subgroups expand and contract over time and requirements change. Novel research projects often emerge spontaneously from interaction within the group, and these facilities will promote that collaboration. Furthermore, this approach will aid in the development of a true “lab culture,” which makes for more productive relationships among colleagues.

The speech and vision groups require better facilities for the study and analysis of data. The speech group currently conducts their research within a small, poorly equipped space. All of this negatively impacts the group's ability to conduct novel research. Further, the group needs usability space for experiments that might extend to a month at a time, which is currently unavailable on campus.

### 3D Display Research Room

Video gaming has become an important field of research in recent years. Typically, this research is interdisciplinary with a strong HCI/Interaction/graphics focus. Seemingly, there are

no other games content research groups at the University of Toronto. The equipment and software required by this research — large screen displays, a variety of gaming devices, and novel input devices — is essential and will benefit from office spaces that are integrated with the usability and active rooms within the centre.

Dgp and KMDI have a long history of research into multimedia meetings and conferencing. Needed is a dedicated space to expand this synergistic relationship into new exciting new areas of research. This space would include numerous large screen displays, interactive white boards, and a variety of video/audio input and output devices. Again, no such facilities exist on campus.

### Server Room

The Computer Science Department's server/machine rooms are at capacity, and are not structured to provide access to students to conduct research. The Centre will include a new open-access machine room where researchers can work *in situ* with experimental and operational computer clusters, media recording, and storage gear. This machine room could be accommodated within Bahen room 5290 if current activities in the existing server room can be relocated. The server room will greatly facilitate the agendas of the systems and networking researchers working in the centre, and will be unique on campus in providing open-access to researchers, in contrast to traditional machine rooms intended for stable computing needs.

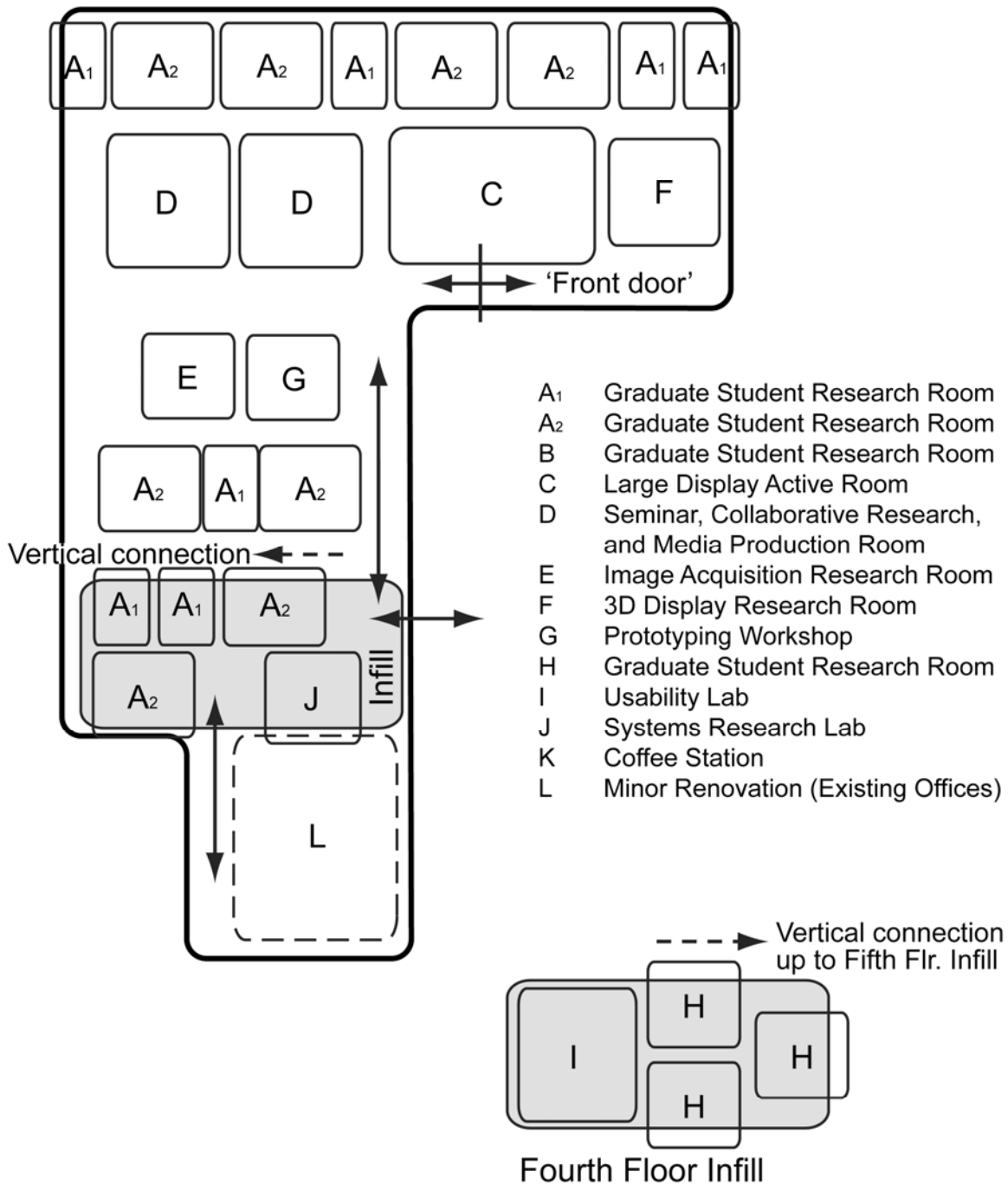
In summary, the major programmatic elements of the CCIDM can be seen as fully transforming the media agenda at the University of Toronto. The Centre will provide a focal point for advanced research in digital media, and will allow its users to connect with other groups for producing content; research on digital media content production; and engaging in research on the effective delivery and use of digital media. As indicated above, the synergies enabled by the creation of such a hub are extremely exciting. The high communications bandwidth in and out of the facility will also ensure connectivity to external projects.

Please see Space Program on following page.

### Space Program for Centre for Collaborative Interactive Digital Media

	Quantity	Stns	Room Size NASM	NASM
<b>New Space (by renovation and infill)</b>				
<b>Graduate Research Rooms</b>				
Graduate Student Research Room	7	3	14.0	98.0
Graduate Student Research Room	8	6	28.0	224.0
Graduate Student Research Room (for Usability Lab)	3	5	24.0	72.0
				<b>394.0</b>
<b>Laboratory Space</b>				
Seminar, Collaborative Research & Media Production Room	2		50.0	100.0
Large Display Active Room	1		100.0	100.0
3D Display Research Room	1		42.0	42.0
Prototyping Workshop	1		24.0	24.0
Image Acquisition Room	1		24.0	24.0
Usability Lab	1		50.0	50.0
Systems Research Lab	1		30.0	30.0
				<b>370.0</b>
<b>Support Space</b>				
Coffee Station	1		6.0	6.0
	<b>27</b>	<b>84</b>		<b>770.0</b>
<b>Rm #</b>	<b>Existing Office Space to be renovated</b>			
5212	1	5		28.97
5214	1	2		17.15
5216	1	1		11.03
5233	1	5		32.93
5235	1	6		28.65
		<b>19</b>		<b>118.7</b>
<b>Grand Total for CCIDM</b>				<b>888.7</b>

See Functional Layout diagram (below). Note: This is a diagram to show general adjacencies, key connections and access points only. The available budget will dictate the amount of renovation feasible and the room arrangements will be explored in more detail during the design process.



### **c. Building Considerations**

The new CCIDM should be in keeping with the existing Bahen Centre in terms of its outward appearance of finishes and design details. Where feasible, similar materials to those already found in Bahen should be used for the public faces of the CCIDM.

Structural considerations for the infill areas will dictate column reinforcement requirements for the supporting members that extend downward through room 3200 all the way to the ground floor level. This may create some secondary effects during the project's construction.

A connecting stair should be provided between the new fourth and fifth floor infill areas as well as a direct horizontal connection between the fifth floor infill and the rest of the CCIDM renovated areas.

Natural light (direct or indirect) should be provided for the graduate student research rooms.

As much as possible given the functional requirements, existing partitions, finishes (carpet flooring, ceiling tiles) and lighting should be retained or reused.

### **d. Site Considerations**

The Bahen Centre is still relatively new so no issues of deferred maintenance or hazardous materials exist.

The design team must confirm that the supply ductwork at the 4<sup>th</sup> and 5<sup>th</sup> floor levels are sized sufficiently large to accommodate the additional air flow required without causing noise issues in the existing system. It should be noted that no form of perimeter heat exists at the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> floor levels and must be added. (Radiant panels are used throughout the rest of the building.)

The existing data closet cooling system consists of a roof-top evaporative cooling tower and a cooling water loop into which direct expansion air conditioning equipment discharge their heat. It is rated for 148 tons of refrigeration and is currently at capacity.

### **e. Campus Infrastructure Considerations**

There are no foreseeable problems with the available electrical supply. No requirement for emergency power has been identified.

### **f. Secondary Effects**

#### Temporary effects (during construction)

Direct secondary effects of the project include the loss of use of room 3200 during the first stage of construction, the building of the infill areas directly above this room. The Department of Computer Science has found that this loss of study space will be acceptable on temporary basis provided that the work occurs during the May to September period with room 3200 opening again for use by early December 2010.



Another direct secondary effect will be the loss of existing research laboratories and graduate student research space during the renovation of the dgp and Systems lab portions of the project. This loss will be partly mitigated by the phased construction approach of the infill areas. By constructing and fitting out the infill floor areas in advance of renovating the other fifth floor areas, approximately 210 NASM of space will be available to be used as staging space during the second phase of work. However, this leaves over 400 NASM of research space that will be unavailable for the duration of the renovation work, from 4 up to 6 months. DCS anticipates that they will be able to accommodate most of these activities between existing office space and the new infill for the duration of construction and does not anticipate a need for renting or finding other temporary space.

Rooms 5212, 5214, 5216, 5233 and 5235 will likely receive only minor renovations by way of adding connecting doors and could conceivably be in use during the work with minor disruptions.

There is also a possibility of requiring destructive or at least disruptive work within rooms 2210 and 2220 (DCS computer labs) on the Second floor and rooms 1200, 1210, 1220 (OSM classroom, tiered lecture halls of 85 seats each) on the Ground floor during the structural column upgrade portion of the project. The extent of this work is to be confirmed by the structural consultant. Construction work should be scheduled so as to not disrupt academic activities in these areas.

While it should be possible to construct hoarding for the renovation that will segregate dust and other construction debris from the rest of the Bahen Centre, there will be construction noise to varying degrees of amplitude throughout the course of the project. Arrangements should be made, where feasible and within budget, to schedule the most disruptive aspects of the work outside of normal class hours.

### Long term effects

The existing server room 5290, which currently houses a number of DCS servers, will be used to accommodate new CCIDM servers. DCS will relocate some of their existing servers from this space to the Sandford Fleming Building to allow room for the new CCIDM activity.

By constructing the infill areas of this project, existing rooms with glazed wall that face onto the void above room 3200 will lose their access to indirect natural light. This includes rooms 5212, 5214, 5216 (graduate student or PDF offices) and 5218 (DCS student lounge) on the fifth floor and rooms 4206 (DCS research lab) and 4218 (DCS PDF multi-office) on the fourth floor.

A corridor or access from the new infill area to Stair 5220S may be required, which would mean cutting through room 5216 on the fifth floor and room 4218 on the fourth floor. This possibility can be confirmed during the more detailed design stage of the project's implementation.

## IV. RESOURCE IMPLICATIONS

### a. Total Project Cost Estimate

The Total Project Cost, including all taxes, contingencies, secondary effects, permits and professional fees, landscaping and miscellaneous costs, but not including any furnishings or equipment, is estimated to be \$3,187,000.

See Appendix 4 for Total Project Cost estimate.

### b. Schedule

- AFD approval for structural consultant fee      December 11, 2009
- Structural consultant appointed                      December 2009
- Planning and Budget approval                        January 18, 2010
- Business Board Approval                                February 8, 2010
- Architect selection & appointment                    by end February, 2010
- Construction start (Phase I infill)                    May 2010
- Infill fit-out and ready for occupancy                December 2010
- Phase II renovation                                        May 2011
- Occupancy    December 2011

### c. Operating Costs

Using an assumption of an addition of 210 NASM (290 GSM) and 100 work stations, Facilities & Services predicts the following outcomes:

#### Utilities

No additional costs are foreseen for heating but the costs to cool the heat generated by 100 workstations is estimated at \$3,043 per annum.

Additional electricity costs to supply the work stations are estimated at \$29,024 per annum.

#### Operation and Maintenance

In the Bahen Centre these costs are charged at a rate equivalent to \$64.93/GSM or \$18,830 for this additional space. This would include cleaning, waste management, police, fire prevention, mail services, as well as building fabric, mechanical, electrical and elevator maintenance.

In addition, there would be an estimated OTO cost for recycling equipment of \$7,000 plus taxes.

**d. Funding Sources and Cash Flow Analysis**

Funding sources for the construction of the project include \$ 2,987,000 from the CFI/ORF grant award and a contribution from the Faculty of Arts & Science of \$200,000.

In line with CFI guidelines, there is no provision for interest charges in the TPC. Advance funding will be provided by the faculty or advance spending through the University as needed to avoid interest charges.

**V. RECOMMENDATIONS**

THAT the Planning and Budget Committee recommend to the Academic Board:

- (i) the Centre for Collaborative Interactive Digital Media Project Planning Report be approved in principle,
- (ii) the project scope as identified in the Project Planning Report be approved in principle at a Total Project Cost of \$3,187,000 with funding as follows:

Canada Foundation for Innovation	\$ 1,493,500
Ontario Research Fund	\$ 1,493,500
Faculty of Arts & Science	\$ 200,000
<u>Total</u>	<u>\$ 3,187,000</u>

## Appendix 1

### Existing areas to be renovated or reconfigured

Fir	Room	Dept Name	Code	Category	Stns	Room Alloc Comments	Area
5	5167	Computer Sci	3.1	Research Lab Space	0	Research Lab - dgp	71.58
5	5169	Computer Sci	3.1	Research Lab Space	0	Research Lab - dgp	36.75
5	5173	Computer Sci	3.1	Research Lab Space	15	Research Lab - dgp	100.49
5	5173A	<i>Non Assign.</i>	16.2	<i>Other Non-Assignable</i>	0	<i>Data Closet</i>	3.84
5	5175	Computer Sci	3.1	Research Lab Space	0	Research Lab - dgp	71.58
5	5177	Computer Sci	3.1	Research Lab Space	0	Research Lab - dgp	72.70
5	5181	Computer Sci	3.1	Research Lab Space	0	Research Lab - dgp	71.12
							<b>424.22</b>
5	5176	Computer Sci	3.1	Research Lab Space	0	Research Lab - Systems	74.02
5	5178	Computer Sci	3.1	Research Lab Space	0	Research Lab - Systems	58.69
5	5180	Computer Sci	3.1	Research Lab Space	0	Research Lab - Systems	58.61
					<b>35</b>		<b>191.32</b>
						<b>Total Lab Area Affected</b>	<b>615.54</b>
5	5212	Computer Sci	4.3	Graduate Student Office	5	Graduate Office Multi	28.97
5	5214	Computer Sci	4.2	Research Office/Project	2	PDF Office Multi	17.15
5	5216	Computer Sci	4.4	Dept Support Staff Office	1	Tech Supp Office Single	11.03
5	5233	Computer Sci	4.3	Graduate Student Office	5	Graduate Office Multi	32.93
5	5235	Computer Sci	4.3	Graduate Student Office	6	Graduate Office Multi	28.65
					<b>19</b>		
						<b>Total Office Affected</b>	<b>118.73</b>
				<b>Total Stations</b>	<b>54</b>		
						<b>Total Exist. Affected</b>	<b>734.27</b>
3	3200	Computer Sci	5.5	Study Space	25	Great Hall of Computing	183.93
					<b>25</b>	<b>Total Study Affected</b>	<b>183.93</b>

**Appendix 2** Equipment / Furnishings Schedule (available on request)

**Appendix 3** Room Specification Sheets (available on request)

## Appendix 4 Total Project Cost Estimate

### CCIDM Bahen Centre

Items	CCDM	
<b>GSM</b>	<b>1,135</b>	721 NASM per data sheets. 288 GSM new, balance renovations.
Construction amount Spring 2010	\$2,261,500	
Construction Contingency	\$226,150	at 10%
Applicable HST	\$84,829	
<b>Total construction, including GST</b>	<b>\$2,572,479</b>	
Infrastructure Upgrades in Sector	\$0	na
Demolition	\$0	incl in constr
Secondary effects	\$0	temp impacts incl in constr.
Permits & Insurance	\$13,000	
Professional Fees	\$431,036	Arch + disburse + misc + PM
Computing Infrastructure	\$0	hardware nic
Telephone set & install	\$5,000	
Audio/Visual	\$0	nic
Moving	\$5,000	
Staging	\$5,000	
Furnishings	\$0	nic
Equipment	\$0	nic
Security & access systems	\$0	incl in constr
Signage: Interior & Exterior	\$7,000	
Miscellaneous incl trades	\$40,000	
Project Contingency	\$108,485	
Finance Costs, allow	\$0	fully funded
<b>Total Project Cost Estimate</b>	<b>\$3,187,000</b>	

prepared jcb Dec 17 2009

scope as per memo of Sep 29 2008



University of Toronto  
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## MEMORANDUM

**DATE:** September 29, 2008

**PI Name:** Eugene Fiume

**Project Name:** Construction of a Centre for Collaborative Digital Media

**Project ID #:** 21570

**From:** Julian Binks  
Manager, Capital Project Planning

**cc:** Adrienne De Francesco, Sheila van Landeghem

**RE:** **Provisional Estimate of Total Project Cost (TPC)**

We have provisionally estimated the TPC of your construction work to be \$3,187,000 for purposes of your CFI submission.

In the case of your proposed construction, it consists of 1,154 GSM (721 NASM) of a mix of new construction and renovation. The new construction consists of two levels of infill to what is presently the triple height room 3200, plus an interconnecting stair on the fourth and fifth floor of the Bahen Centre for Information Technology. The scope includes structural, new mechanical and electrical services, new raised floor, partitioning, and modifications to the existing glass partitioning.

The renovation is to a portion of the 5<sup>th</sup> floor, specifically the NW sector. To the greatest extent possible the existing partitions, flooring, mechanical & electrical systems and ceilings will be retained, with new program areas being created by subdivision of existing rooms.

In line with CFI guidelines, this total includes, in addition to an estimate of the base construction amount, allowances for soft costs (taxes, permits, professional fees), and contingency.

The costs have been escalated to an assumed tender date of mid 2010. The estimate does not include amounts for research equipment, A-V equipment, furnishings or fixtures that may be part of your application.

If you have any questions regarding this estimate, please contact Bennett Kim. He can be reached at extension 82218 and his email address is [bennett.kim@utoronto.ca](mailto:bennett.kim@utoronto.ca).