

UTSC SOUTH CAMPUS DATA CENTRE

**Project Planning Committee Report
October 2009**

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Part A: Executive Summary

The current Information and Instructional Technology Services (IITS) Data Centre at the University of Toronto Scarborough (UTSC), built in 1997, requires more space, better security, power and cooling and cannot be easily upgraded. It no longer meets industry standards. No major expansion or significant upgrades have occurred during the 12 years since it was built, yet the campus has changed dramatically during the same period. Since that time UTSC has added 38% more academic and residence space, the undergraduate student population has grown by 97%, and there has been a massive migration of paper-based business process onto IT infrastructure. Presently, all University core administrative and academic business processes (AMS, ROSI, LMS, etc.) fully rely on IT. These changes combined have stretched the UTSC information technology infrastructure to the limit making it very difficult to improve existing and impossible to implement new IT services and placing its operations at risk. Limitations imposed by the current UTSC data centre prevent IITS from building the required information technology infrastructure and services needed to support growing academic and administrative demands.

The South Campus Data Centre will address the existing electrical, cooling, security and maintenance issues, allow for the improvement of existing services and introduction of new services, and lay the foundation for future development of connectivity and IT services redundancy which does not currently exist on campus or at UofT.

The proposed South Campus Data Centre will be the first step towards the creation of a data centre cluster at UTSC that will be fully realized with the opening, in 2011, of the North Campus Data Centre in the new Instructional and Laboratory Centre, currently under construction. The UTSC data centre cluster will provide fail-over capacity, which is an essential business continuity requirement.

The project has been developed in coordination with the Office of the Chief Information Officer. UTSC will seek to build the physical space for the Data Centre to satisfy recommendations and best practices for offsite data storage and replication. It will be large enough to potentially house backups for University-wide IT systems (such as AMS, ROSI, Exchange, Blackboard) and could be used to house IT appliances from other divisions and from UTM. However, at this stage it is considered only as a potential facility for offsite data storage and the replication of central IT services. Additional discussions and planning would be required. The UTSC project will not provide for power, cooling or computing equipment required by non-UTSC IT systems.

The Report of the Project Planning Committee for the UTSC South Campus Data Centre is the culmination of an application that was submitted to, and approved by, the Accommodations and Facilities Directorate (AFD) in April, 2009 to retain consultants for the review of scope and budget for the proposed construction of the centre.

The project (182 square meters) is to be constructed on the roof of the ARC (Academic Resources Centre) with infrastructure sufficient to accommodate at least 16 racks of computing equipment and is estimated to have a Total Project Cost of \$3,904,000.

The new data centre is replacing the existing facility; no additional operating costs are expected for the new data centre, however the construction of 182 gross square meters will increase operating costs at UTSC by approximately \$20,000 annually.

The proposed UTSC South Campus Data Centre will be fully funded by the University of Toronto Scarborough. No borrowing is required.

Part B: Project Background

Membership

Zoran Piljevic, Director, Information and Instructional Technology Services (Chair)
John Harper, Manager – Systems and Networking, IITS
Professor Richard Pancer, Department of Computer and Mathematical Sciences
Michael Richard, Director, Design and Construction Management (and Project Manager)
Jim Derenzis, Director, Facilities Management
Julian Binks, Manager, Capital Projects Planning, Real Estate Operations
Gail Milgrom, Managing Director, Office of the VP Campus and Facilities Planning

Terms of Reference

1. Make space recommendations and provide functional layout for the UTSC data centre.
2. Identify all secondary effects, including space reallocation from the existing site.
3. Identify required changes in the existing computer network configuration and their estimated cost.
4. Identify equipment and movable furnishings necessary to the project and their estimated cost.
5. Identify all data, networking and communication configurations and their related costs.
6. Identify required electrical, cooling and fire suppression configurations and their related costs.
7. Identify all security, occupational health and safety and accessibility requirements and their related costs.
8. Identify all costs associated with transition during construction and secondary effects resulting from the realization of this project.
9. Determine a total project cost estimate (TPC) for the capital project, and also identifying all resource costs to the University.
10. Identify all sources of funding for capital and operating costs.
11. Complete report by September, 2009

Background Information

The existing IITS data centre was built in 1997. There has been no expansion or significant upgrades in the 12 years since it was built. However, the UTSC environment has changed dramatically as shown on the next page:

**Comparison of 1997 to 2009
Servers, Students, Faculty & Staff, Gross Area and Business Functions**

	1997	2009
Number of servers	10	52 (420% increase)
Headcount Undergraduate Students	5,254	10,360 (97% increase)
FTE Budgeted Faculty and Staff	362	649 (79% increase)
Gross Square Meters South Campus (including residences)	76,700	106,000 (38% increase) + Academic Resource Centre Arts and Admin Building Student Centre Management Building Science Research Bldg Foley Hall Residence
Critical Business Functions	Still partly paper-based. No single point of failure. No risk to University mission.	All University's critical business functions fully depend on IT. UTSC data centre single point of failure. University's mission at risk.

All of these changes have put a great strain on the UTSC IT infrastructure. A recently conducted internal audit indicated that risk to business interruption is moderate to high, largely due to the inadequate data centre.

Issues with the current data centre:

Issue	Status	Comment
1. Power	At capacity	New equipment can be added only if the existing one is taken out. No ability to add any new services.
2. Cooling	At capacity (need to use fans as AC is insufficient)	Running at 100%. Failure to any existing AC units brings the temperature above safe operating level.
3. Security	At risk	High traffic area in drywall enclosure. Currently exposed 24/7 with limited additional security.
4. Maintainability	Very difficult	Repairs cannot be done without incurring an outage to the entire data centre.
5. Business continuity	Cannot be ensured	No possibility to add redundancy to the computing network or to core services.

The Accommodation and Facilities Directorate, at its meeting of April 8, 2009 approved the application from UTSC to retain consultants for the review of scope and budget for the proposed expansion of the UTSC Data Centre from its current location in the Bladen Wing.

Statement of Strategic Plan

The UTSC Strategic Plan stems from five strategic directions:

- 1) to create an environment to house and support the growth of new and emerging fields of scholarship,
- 2) to expanding its onsite graduate training at the Masters and PhD levels to 10+ percent of the total student population,
- 3) to become an international hub for learning and partnership within the UofT system,
- 4) to be a leader in experiential learning by offering curricular, co-curricular and extra-curricular opportunities for students,
- 5) to ensure that the best people, appropriate resources and excellent facilities and programs are in place to provide and exceptional place to work and learn.

IITS presently lacks the infrastructure and facilities required to support the UTSC Strategic Plan. Existing IT services cannot be expanded and new services cannot be added due to the limitations of the current data centre. The proposed South Campus Data Centre would provide sufficient capacity to create the IT services required by the UTSC strategic plans. It will also provide required stability, reliability and high availability of IT services - mandatory to support the academic mission of UTSC.

Space Requirements

UTSC seeks a new data centre to accommodate at least 16 racks of equipment, which is the estimated long-term requirement for UTSC's South Campus. The proposed Data Centre will be accommodated in approximately 1956sf (182sm) of space and will be connected to generator power. The roof of the ARC is structurally designed with additional capacity and, therefore, is an appropriate location for the new Centre.

The design for the proposed UTSC South Campus Data Centre is being done in coordination with the Office of the Chief Information Offices (CIO). As per agreement with the CIO, UTSC will seek to build the physical space for the UTSC Data Centre large enough to house backups for University-wide IT systems (AMS, ROSI, Exchange, Blackboard). In addition, available space could be used to house IT appliances from other divisions and from UTM. The UTSC project, however, will not provide power, cooling or computing equipment required by non-UTSC IT systems.

Part C: Project Description

Vision Statement

Information and Instructional Technology Services envisions creating a data centre cluster at UTSC with a robust, powerful and flexible IT infrastructure that will meet the University's expanding academic and administrative activities. This UTSC cluster would be integrated with the IT infrastructures at UTM and St. George and could house UofT enterprise applications such as AMS, ROSI, LMS and Exchange. This would be achieved through a two-phased approach detailed below.

Phase 1 – A new IITS data centre on the South Campus will resolve immediate issues with space, power and cooling as well as with physical security. In addition, it will provide infrastructure that will enable IITS to start addressing business continuity issues through the introduction of redundancy of computer network connectivity and the redundancy of core IT services.

Phase 2 - The creation of another data centre on the North Campus and the decommissioning of the current one in the Bladen wing will complete the two-phased plan. The new data centre on the North Campus will be the aggregation point for networking on the new campus and will provide space to virtualize and replicate core UTSC IT services. This data centre is being built as part of the UTSC Instructional Centre which is currently under construction. The two data centres, North and south, will be cross-connected ensuring the uninterrupted delivery of IT services if one data centre were to be taken offline

The UTSC Data centre strategy is being done in coordination with the Office of the Chief Information Officer. The ultimate goal is to build a robust, flexible and redundant University-wide IT infrastructure necessary to ensure uninterrupted delivery of academic and administrative services.

Space Program and Functional Plan

The proposed UTSC Data Centre is part of long-term IT vision at UTSC with a goal to create a fail-proof network and systems infrastructure. The first phase, discussed in this report, will require the construction of 182sm (1956 sq.ft.) of space to accommodate 16 servers that will resolve immediate issues with space, power and cooling as well as with physical security. Additional capacity within this structure may accommodate other multi-campus initiatives.

UTSC is in the process of upgrading networking closets and replacing obsolete Ethernet cables in the Science and Humanities wings. Through this process IITS is also reconfiguring its core wired network by introducing demarcation closets for each building. This configuration provides much better network stability and flexibility. In addition, it allows IITS to isolate and contain eventual network issues thus minimizing the number of users affected and network down time. This newly reconfigured network will tie into the South Campus Data Centre being proposed in this plan.

Building Considerations

The proposed South Campus Data Centre will be built on the roof of ARC according to the requirements outlined in Appendix C.

Site Considerations:

The UTSC south Campus Data Centre will be built on the roof of Academic Resources Centre. The ARC building, opened in 2004, was originally designed to support another floor and, therefore, should have structural capacity to carry the load of the Data Centre.

The Data Centre, as currently modeled, is some 14' in height to be located adjacent to the Bladen building and away from the existing roof edge. As such, the new facility is not expected to be seen from the ground, nor will it be highly visible from the podium level, and thus is not expected to produce a negative visual impact on campus. Furthermore, the current plan for implementation of this project suggests a tie-in with an existing stair, thus eliminating any intrusion into the operations of facilities below.

Campus Infrastructure Considerations

The proposed Data Centre will be connected to the building's existing water and power sources. It will also have a data conduit to the existing UTSC data centre in BV476 until the North Campus Data Centre is operational.

Secondary Effects

The proposed two-phase expansion will free up space in the current server room for research equipment. Presently, Professor Nicos Koudas from Computer and Mathematical Sciences has no space to install four racks of computing equipment for the BlogScope/Sysomos project for which \$500,000 of provincial funding (partially funded by a CFI) has been received. Once the proposed Data Centre is operational, IITS will vacate the current server room and free up space for such research projects.

Schedule

- | | |
|-----------------------|------------------|
| 1. Project approval | October, 2009 |
| 2. Project completion | January 30, 2010 |

Part D: Resource Implications

Total Project Cost Estimate

Total project cost is estimated to be \$3,904,000.00

Operating Costs

The additional 182 gross square meters will increase the operating costs of UTSC by \$20,000 annually. Space released by the relocation will be assigned for other use at UTSC.

Funding Sources and Cash Flow Analysis

The UTSC South Campus Data Centre will be fully funded by the University of Toronto Scarborough. No borrowing is required.

Part E: Recommendations

It is recommended that the Planning and Budget Committee recommend to the Academic Board:

1. That the Project Planning Report for the University of Toronto Scarborough Data Centre be approved in principle.
2. That the project scope, comprising new construction of 182 square meters on the roof of the Academic Resources Centre at a total project cost of \$3,904,000.00 be approved with the full funding from the University of Toronto Scarborough.

APPENDICES:

Appendix - 1

Current Electric Power Consumption analysis

Rack #	Amps	@208V	kVA	Comment
1	1.8	0.3744		Measured UPS load at panel
2	0	0		Fed from Racks 1 and 2
3	28.4	5.9072		Measured UPS load at panel
4	17.5	3.64		Measured UPS load at panel
5	5.5	1.144		Measured UPS load at panel
6	13.3	2.7664		Measured UPS load at panel
7	16.4	3.4112		Measured UPS load at panel
8	24	4.992		Measured UPS load at panel
9	23.3	4.8464		Measured UPS load at panel
10	22.1	4.5968		Measured UPS load at panel
11	/ 2.4	75%		of 16kVA UPS / 5 racks
12	/ 2.4	75%		of 16kVA UPS / 5 racks
13	/ 2.4	75%		of 16kVA UPS / 5 racks
14	/ 2.4	75%		of 16kVA UPS / 5 racks
15	/ 2.4	75%		of 16kVA UPS / 5 racks
Total 43.6784				kVA
per rack (15)				2.911893 kVA / rack

Smith

Appendix 2 – Total Project Cost Estimate

		University of Toronto at Scarborough Design & Construction Management	Project: Campus IT Centre	Project Manager: Ryan D'Souza	
		TOTAL PROJECT COST (TPC)	DCM2008-32	Revised:	29/9/09
Number	Item	Remarks	Base Cost	GST (1.65%)	Cost
CONSTRUCTION					
835730	Construction: Main Contract	Design/Build	2,951,991	48,708	3,000,699
835732	Construction: Other Contract	Preparation of new/existing remote closets	100,000	1,650	101,650
835754	Secondary Effects	Exterior covered walkway	110,000	1,815	111,815
835757	Construction Contingency		-	-	-
835762	Hazardous Waste Removal		-	-	-
835731	Electrical		-	-	-
835734	Locksmith		-	-	-
Total Construction					\$3,214,164
LANDSCAPING					
835755	Landscaping Services		-	-	-
Total Landscaping					\$0
PERMITS, INSURANCE					
835400	Licences / Permits		25,000	413	25,413
836700	Insurance	Calculated at 0.30% of Main Contract	7,500	124	7,624
Total Permits, Insurance					\$33,036
PROFESSIONAL FEES					
835200	Consulting	included in main contract	-	-	-
835201	Consultants: Disbursements	5% of fees	-	-	-
835204	Construction Management Fees		-	-	-
835206	Other Consultants		-	-	-
835210	Legal Services		-	-	-
835721	External Project Manager		-	-	-
895720	Design Fees: In House	2.50%	-	-	-
895721	Design: Disbursements	Meals, parking, mileage, printing	-	-	-
835723	Project Disbursements	Meals, parking, mileage, printing	-	-	-
895725	Project Management: Fees	5.50%	176,000	-	176,000
Total Professional Fees					\$176,000
SERVICES TO SITE					
835700	Site Services and Infrastructure		-	-	-
Total Site Services					\$0
COMPUTER WIRING AND TELEPHONES					
821110	Equipment: Computing: Purchase	Server Racks and Core/Data Centre Switches	455,000	7,508	462,508
835010	Telephone Line Service		500	8	508
					\$463,016
MOVING AND STAGING					
837100	Moving		-	-	-
837101	Staging		-	-	-
Total Moving and Staging					\$0
FURNISHINGS AND EQUIPMENT					
820010	Furniture: Purchase	included	-	-	-
821010	Equipment: Purchase	Fume hoods (included)	-	-	-
821510	Equipment: Audio / Visual: Purchase		-	-	-
821610	Equipment: Research: Purchase	PST is not applicable	-	-	-
Total Furnishings and Equipment					\$0
OTHERS					
820011	Interior Signage: Purchase / Design	UTSC - Machine Shop	-	-	-
821325	Security and Access Systems		-	-	-
835780	Parking	UTSC	5,000	-	5,000
835756	Exterior Signage: Purchase / Design		-	-	-
835764	Client Construction Expenses		-	-	-
835760	Disposal	UTSC	-	-	-
836900	UTSC Forces - FMD	Cleaning	800	-	800
836430	Donor Recognition		-	-	-
890670	Facilities Repair/Renovation: Internal		2,000	-	2,000
Total Others					\$7,800
SUB TOTAL:					\$3,894,016
PROJECT CONTINGENCY					
835758	Project Contingency		10,000	-	10,000
Total Project Contingency					\$10,000
FINANCE COSTS					
835305	Interest Charges	7% @ 6 mnths	-	-	-
Total Finance Costs					\$0
TOTAL PROJECT COST:					\$3,904,016
Design & Management Dept. Fees		Prepared By: Michel Richard	Approved by:		
176,000.00		10/5/2009 8:30	Date:		

Appendix 3 – South Campus Data Centre – Building Requirements

Data Centre Rating Goal:

- Tier 3 dual-powered equipment and multiple uplinks; multiple active power and cooling distribution paths with single active path.

Electrical:

- 225-250 KVA/3 phase transformer on generator power
- Direct feed of UPS from transformer and generator or utilization of an automatic transfer switch to feed UPS.
- 3 phase UPS with minimum 40KVA output expandable to 100 KVA to support 1-15 minute run-time
- Meters on circuits for load determination
- Overhead power drops on rack (typically 220V L6-30 to connect to rack PDU)
- 120V drops on all perimeter walls
- Scalable power run that enables second UPS to be connected without cutting off power to primary UPS.

Cooling:

- Multiple chillers at a minimum capacity of 20 ton (minimum two units to allow for maintenance shut-downs and redundancy)
- Chillers to be on emergency power generator
- Cooling to support 16 racks.

Fire suppression:

- People-safe dry fire suppression system
- No halon system

Cabling:

- 24 multiple mode and 24 single mode fiber run between existing and the new data centres
- A data connection must be provided from BV476 to the new Data Centre

Architectural:

- Anti-static floor load rated to 150 lb/sq.ft
- Fixed shelving for cables, cords, tools, etc
- Emergency lighting
- Adjustable track lighting between racks
- Administrative space

The UTSC South Campus Data Centre should be designed to meet Tier 3 data centre standards and the highest reasonable LEED standards. Particular attention should be paid to power and cooling efficiency.

