PROJECT PLANNING REPORT
SciNet High Performance Computing Project

September 15, 2007

Prepared By:
Office of Planning and Information Technology, Office of the Dean
Faculty of Arts & Science, University of Toronto

40699

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The history of the development of SciNet at the University of Toronto stretches back to 1999 with the timing of an award of $7.38M from the Canadian Foundation for Innovation and the Province of Ontario for the founding of PSciNet, an acronym which then stood for the Physical Sciences computing NETwork (PSciNet). This funding was received in response to an application prepared by a group consisting of astrophysicists from the Canadian Institute for Theoretical Astrophysics, chemical physicists from the Department of Chemistry and planetary physicists from the Department of Physics. The funds were invested to acquire three distinct computer systems, each one designed to serve the special needs of each of these collaborating groups and to be operated by them as separate systems.

A second proposal to CFI for further PSciNet development was funded in 2003 for $11.2M, this time to a group consisting of high energy experimental physicists from the Department of Physics, planetary physicists from the Department of Physics and a third group consisting of aerospace and mechanical engineers from University of Toronto Institute for Aerospace Studies and from the Department of Mechanical and Industrial Engineering. This funding was employed to acquire 2 new cluster systems as well as an upgrade to the vector system employed by the planetary physics group. The newly incarnated "SciNet" with the "P" for "Physical" now dropped from the acronym has been developed through the continuing collaboration of all five of these previously involved groups, joined by their colleagues from the areas of computational biology, genomics and bioinformatics.

The systems to be acquired by SciNet will be operated as an integrated resource that will be widely accessible, not only to members of the University of Toronto community initially, the faculties of Medicine (including ten affiliated teaching/research hospitals), Applied Science and Engineering; Arts & Science and UTSC, but also to others from the wider Canadian community able to justify their need for access to the extremely powerful facility that we are constructing.

The SciNet consortium has been funded by a National Platform Fund (NPF) award from the Canada Foundation for Innovation (CFI) and the Province of Ontario. SciNet is expected to be the most powerful academic High Performance Computing (HPC) facility in Canada.

This tremendous new computing capability will enable ground-breaking research across the entire range of disciplines represented within the consortium including aerospace and biomedical engineering, bioinformatics, chemical physics, climate modeling, cosmology, genomics and high-energy physics. The new SciNet computer systems will be operated as a unified resource that will be available to researchers from anywhere in the province via the Optical Advanced Network of Ontario (ORANO) as well as to collaborating researchers from across the country via the CANARIE-financed national network CAnet 4. This collaboration is a mandated requirement for all consortia funded by the NPF.

The space and power requirements for the installation and operation of the envisioned facility are significant – there is no data centre of this magnitude planned for any other Canadian university. After an extensive search and investigation of several possible sites, including some on the U of T campuses, the SciNet Committee concluded that the most cost-effective option was to rent space for the HPC portion of the project with the requisite electrical power capacity.

Accordingly, the University has secured approx. 1,100 square metres of net rentable space which will be able to accommodate all the proposed infrastructure and provide up to 3MW of power capacity to operate the HPC and provide the required cooling.

The terms of the rental agreement align with the current funding of 5 years, with an option to extend for an additional 5 year lease if additional funding is secured. The goal is to commence operations in April 2008 with a significant fraction (25%) of the final computing capacity installed and operational. The remainder of the systems will be purchased and installed in the following two years.

The SciNet Capital Project consists of two parts. While the hardware can easily be located off-campus, the human component of SciNet needs to be close at hand in order to facilitate interaction with the users, as well as collaboration with colleagues across the University, and nationally with the other HPC consortia. Therefore, the second portion of the SciNet Capital Project is an Administration/Technical Operations/Collaborative suite on the St. George Campus.

The project will house the majority of the technical staff, as well as all the scientific, and administrative staff in 256 McCaul Street within approximately 320 NASM**.** This location will ensure that the SciNet resources are utilized and managed as effectively and efficiently as possible, in support of the hundreds of faculty, postdoctoral fellows, graduate and undergraduate students who will be conducting HPC-based research on SciNet systems. Highly-skilled technical analysts with advanced scientific degrees will work closely with researchers to develop and optimize the sophisticated numerical algorithms and programming techniques that are required to take full advantage of modern, massively-parallel computer clusters with thousands of CPUs and modern vector systems. Expert system administrators, with specialized knowledge in current computer hardware, operating systems, large capacity storage systems and high-performance networking will ensure that the various computer systems are operated, integrated and networked in optimal fashion. The McCaul Street SciNet facility will include an "access grid" facility that will enable remote conferencing and collaboration between the researchers on the St. George campus and their peers at other campuses and institutions. This is an essential component to enable the mandated national collaboration.

The cost of the SciNet project has been estimated to be **$**5,882,590 including the Capital Projects required for the Tenant improvement project at the rental premises at 7700 Keele Street ($4,771,970) and the Administrative offices at 256 McCaul Street ($1,110,620). It is understood that SciNet will be fully funded. Participating divisions will cover any shortfall in funding.

I. MEMBERSHIP

E. Sisam	Assistant Vice President, Campus and Facilities Planning
B. Louie	(Acting) Manager, Capital Projects
J. Binks	Project Planning, Capital Projects.
R. Swail	Assistant Vice President, Facilities and Services
B. Dodds	Director of Utilities, Facilities & Services
W. Yasui	Senior Facilities Planner, Campus and Facilities Planning
R. Chambers	Computer & Networking Services, University Computing
J. Chadwick	Executive Director, Government Research Programs
C. Yip	Professor, Institute of Biomaterials and Biomedical Engineering
W.R. Peltier	Professor, Department of Physics
R.S. Orr	Professor, Department of Physics
U.L. Pen	Professor, Canadian Institute for Theoretical Astrophysics
R. Kapral	Professor, Department of Chemistry
C. Groth	Associate Professor, UTIAS, Faculty of Applied Science & Engineering
C. Loken	Facilities Manager, Canadian Institute for Theoretical Astrophysics
G. Quon	Graduate Student, Dept. Of Computational Biology
S. Northrup	Graduate Student, UTIAS
C. Nenkov	Graduate Student, Dept. Of Atmospheric Physics
M. Contreras	Assistant Dean & Director of P&IT, FAS
J. Henderson	Senior Planner, P&IT, FAS

II. TERMS OF REFERENCE

1. Determine a functional layout and space requirements for the enhanced SciNet network for high performance computing (HPC).
2. Make recommendations regarding the location of the Centre and any associated space.
3. Respond to the requirements set out in the application to the Canada Foundation for Innovation and any conditions of the award.
4. Determine a detailed space program taking into account Council of Ontario Universities' and the University of Toronto's space standards.
5. Identify the capital cost of construction, including renovations, utilities, data and communications requirements and the cost of all equipment and furnishings for the SciNet facility.
6. Identify all operating costs for the facility.
7. Identify deferred maintenance issues that could affect the project and possible additional sources of funding that could address these particular issues.
8. Identify all communication and computer networks and interfaces that are required.
9 Identify all proposed sources of funding.
10. Report by July 30, 2007.

III. BACKGROUND

The University of Toronto research community, comprising both university faculty and other researchers located on campus and at the affiliated teaching hospitals, includes a large number of internationally prominent and nationally dominant groups that have a demonstrated and growing need for access to the most capable computational infrastructure available. Although these groups have been successful in acquiring a number of highly-competitive computational infrastructures in the past through the CFI process, the problems that currently define the state-of-the-art in their areas of activity cannot be addressed using available computer systems. By working together on the design of the multi-architecture SciNet constellation, within the context of the recently awarded CFI National Platforms Fund, collaborating faculty are developing a facility able to serve the growing needs of all faculty, post-doctoral fellows, students and affiliated researchers at SciNet member institutions whose areas of research require access to high performance computing capacity. The infrastructure renewal also offers unprecedented opportunities for the development of young research talent and for the commercialization of discoveries made using the powerful HPC facility to be operated by the SciNet Consortium.

The leading groups active in the SciNet Consortium include aerospace engineers, astrophysicists, computational biologists and researchers working in the area of genomics, high energy experimental physicists, planetary physicists and theoretical chemical physicists. The factor which links the scientists and engineers from these disparate research communities together is the extent to which their success depends upon having access to the most powerful computing facilities currently available internationally. Without exception the six groups whose work is highlighted in the SciNet portion of the NPF proposal are the leading groups in their field in Canada. Their competitive positions are extremely important to the province, as it is on the success of their activities that Ontario's position as a leading research jurisdiction in North America and internationally depends. This group has been working together collaboratively for two years on the development of the SciNet plan, which has grown out of their desire to share access to the infrastructure that the quality of their science has attracted to the University of Toronto community. It is only through such a willingness to share that it is possible to ensure that the significant computational resources demanded by the science will be operated at maximum efficiency.

SciNet is part of a larger national academic HPC structure which has evolved over the last eight years in response to CFI funding initiatives. Virtually every Canadian university is now a member of one of the seven HPC "consortia" distributed across the country (WestGrid, SHARCNET, SciNet, HPCVL, Clumeq, RQCHP and ACENET).) A new national organization, Compute/Calcul Canada (CCC), of which SciNet is a full member, has been established to co-ordinate the use of HPC equipment at the national level. Compute/Calcul Canada itself has a formal structure, including a board comprising the VPs-Research or their designates for each of the seven regional consortia lead institutions, and appropriate functional advisory bodies and subcommittees.

The computing systems that will comprise the architectural mix and total resource to be acquired by SciNet have been determined through the deliberations of both the University of Toronto SciNet Committee and the National Initiatives Committee (NIC) that led the process of proposal

preparation to the NPF of the Canada Foundation for Innovation. This equipment will consist of the following:

- A “Capacity Supercluster” consisting of more than 15,000 cores with at least 2 GB of RAM per core for a total of 30 TB. This machine would deliver a peak performance in the order of 150 Tflops.
- A “Capability Supercluster” consisting of as many as 10,000 cores with 4 GB of RAM per core for a total of 40 TB and a peak performance in the order of 100 Tflops.
- A “Parallel Vector” system consisting of as many as 160 CPU’s with 12.5 GB of RAM per CPU for a total of 2 TB and a peak performance in the order of12 Tflops.
- A “Scalable Storage” system on the order of 3 PetaBytes.

It is expected that the capacity supercluster will be an attractive architecture for many scientists working in the areas of astronomy and astrophysics, high energy experimental physics and integrative computational biology. Similarly the capability supercluster will be seen as crucial to researchers working on problems of computational analysis and optimization in applied sciences and engineering as well as in astrophysics and theoretical chemical physics. The parallel vector machine will be vitally important to scientists working in the general areas of climate system simulation, chemistry-climate interactions, hydrodynamics, and the magneto-hydrodynamics of the planetary interior. The scalable storage system will provide data repository capacity for all of the HPC systems in SciNet.

IV. STATEMENT OF ACADEMIC PLAN

Vision and Priorities

SciNet will install a multi-architecture constellation of machines that will become an institutional, provincial and national resource able to serve the needs of faculty and graduate students whose areas of scientific research require access to HPC.

SciNet will bring forth a tremendous computational capacity, enabling a variety of new research endeavours at the University of Toronto. The research encompasses explorations into problems of medical, engineering and scientific disciplines. Some of this research includes building comprehensive network maps that describe the interplay between genes and their relationship to all aspects of cell function; identifying critical protein interactions through statistical analysis of high-throughput and content screening experiments; understanding the mechanism and dynamics of cardiac arrhythmias; designing and optimizing drug synthesis; designing fuel-efficient ultra-low drag aircraft; modeling the climatic effects of greenhouse gases; understanding the origin and evolution of the Universe; and uncovering the nature of matter and the unification of the fundamental physical forces.

It is not enough to obtain hardware in order to be able to accomplish the research goals of the scientists. The human component of the SciNet consortium is equally relevant and necessary for the successful operation of the HPC facility. One of the stated goals of the NPF is the generation, employment and retention of Highly Qualified Personnel (HQP). These are the

people who run the HPC facilities and provide the interface between the researchers and the HPC systems. Attraction and retention of HQP is highly competitive, and essential to effective operations and scientific productivity.

An effective management group, together with highly skilled technicians and analysts, will be the principle contact point for the researchers. Therefore, the human part of SciNet must be located where this interaction with users is best accomplished: on-campus. The facility being proposed for the McCaul site is designed to develop and promote communication and interaction among the various groups involved in HPC, both within the consortium as well as across consortia around the country and indeed globally. A general purpose collaborative teaching/working virtual media room outfitted with Access Grid and other communication technologies is planned for the on-campus SciNet facility.

In addition, and central to the academic plan of the University, is the education and development of highly skilled graduate students and postdoctoral fellows. These individuals are trained not only in their particular fields of research, but also in the utilization of high performance computing in general. In order to build on the experience in the development of highly qualified personnel, SciNet will promote an active program of tutorials, courses and seminars on the utilization of SciNet and GRID computing. This will be supported in part from SciNet funds, and also from the research grants of the proponents. A recent example of what is being planned was the ATLAS Canada Workshop on GRID Computing. This centered on CFI funded equipment from the previous funding cycle. It was attended by 40 graduate students and post docs from throughout Canada. Two experts in GRID computing from CERN, Geneva, ran this workshop and helped the attendees to develop skills in this rapidly expanding area. These activities are planned to be broadcast on the web, so that the content is available to interested parties across the country.

Management Structure

The management model developed by SciNet is motivated by the conviction that this is a facility whose mission is to do science. The management should be responsive to the needs of the scientific user group, should not consume a major time slice for the researchers, and should be as light as possible. Management personnel include the Scientific Director (50% time), Chief Operating Officer, a financial administrator, a training coordinator and a communications/administration support person.

At the highest level, SciNet will have a Board of Directors responsible for budgetary oversight and strategic planning. Its membership will be drawn from the senior management of the university faculties and hospitals associated with SciNet. The Scientific Director and Chief Operations Officer of SciNet will also be members.

Overall executive authority for SciNet will be vested in the Scientific Director. The Director will be a member of the University of Toronto tenured faculty. The Director's primary responsibility will be to represent SciNet in national discussions concerning the development of High Performance Computing. The Director will normally be the SciNet representative on the National Initiatives Committee and a member of the Council of Compute/Calcul Canada. He/She will also chair the Scientific and Technical Advisory Committee of SciNet, and will

supervise the work of the Chief Operations Officer. Working in close collaboration with the Chief Operations Officer, the SD will also be responsible for staffing decisions involving both technical and scientific appointments to the technical and administrative staff. These staffing decisions will require final approval of the SciNet Board of Directors since they have budgetary implications.

The primary responsibility for the operations of SciNet will reside with the Chief Operations Officer (COO). The COO will be a scientist or engineer with a detailed knowledge of the issues in scientific supercomputing, and also an extensive knowledge of modern HPC infrastructure. The COO will be responsible for the management of both the technical staff of SciNet (computer operators, technical analysts) and the administrative employees of the consortium. He/She will play the primary role in implementing the strategy for SciNet technical evolution developed by the Scientific Director, Scientific and Technical Advisory Committee, and the SciNet Board of Directors. The COO will work closely with the Scientific Director to ensure optimal use of SciNet infrastructure by the scientific community. A further responsibility of the COO will be to monitor the use of all systems by both internal and external users and to compile reports on usage statistics for both the Council of Compute/Calcul Canada and the Council of High Performance Computing Ontario. The COO will also be the first point of contact for industrial and government users who wish to obtain access to SciNet infrastructure.

In addition to the Board of Directors and the management of SciNet, there will be three committees which will advise the SciNet management on technical and resource issues. These are the Scientific and Technical Advisory Committee, the Users Committee, and the Local Resource Allocation Committee.

The Scientific and Technical Advisory Committee, chaired by the Scientific Director, will be responsible for the development of the technical strategy for the staged installation and enhancement of the SciNet systems. The committee will have both scientific and technical members drawn from each of the disciplines which represent the most intense usage of HPC resources. Technical staff members of SciNet will also be represented on this committee. The membership will be no more than 15 individuals, who are appointed by the Board of Directors on the basis of nominations by senior Departmental and SciNet leadership. It will meet on a regular basis, and will continuously monitor the usage statistics of all SciNet systems as a means of tracking the fluctuations and trends in user demand.

The Users Committee, chaired by a University faculty member, will represent the needs and opinions of the general user base to the SciNet management. Members will be drawn from the community of faculty and graduate students using the SciNet facilities, and from the technical analyst group. There will be 12 members, and appointments to the committee will be approved by the Board of Directors. This committee will also have the primary responsibility for overseeing the education of the SciNet user base in order to optimize the use of resources.

The Local Resource Allocation Committee will allocate CPU time and data storage in response to applications submitted to it by members of the SciNet Consortium. All use of SciNet resources will be allocated only in response to specific applications from such members of the Consortium. The Committee will consist of knowledgeable HPC users from the wide range of

disciplines represented within the consortium, with the size of this committee anticipated to be in the order of 12 members. The members of this committee will be appointed by the Scientific Director subject to the approval of the Board of Directors. The resources allocated will be based upon both merit and need. However every effort will be made to accommodate the needs of inexperienced users through the provision of a level of support sufficient to allow them to develop the expertise required to make efficient use of SciNet systems. A further responsibility of the LRAC will be to assess the validity of resource requests that are claimed to be in excess of the capacity of SciNet to provide. Only after validation by the SciNet LRAC will such requests be forwarded to the national level where the National Resource Allocation Committee (NRAC) of Compute/Calcul Canada will attempt to have the request satisfied by other national HPC Consortia. The Chair of this committee will normally be a full time faculty member of the University of Toronto.

Within Ontario, the High Performance Computing Council of Ontario (HPCCO) consists of two members from each of the three Ontario HPC consortia (HPCVL, SciNet, SHARCNET), at least one of whom must hold a senior level institutional portfolio (e.g. Vice-President, Research). This group also includes observers (one each) from MRI and MTCU, as well as a single individual from outside the university representing industrial users of HPCCO equipment, and one representative of a University-Industry interfacing organization. The group is responsible for strategy development, operational co-ordination and the compilation of performance metrics for all HPCCO systems.

V. SPACE PROGRAM & FUNCTIONAL PLANS

Current Space Allocations

Dedicated SciNet space does not currently exist at the University of Toronto. It will become a new cross-divisional entity requiring space. The faculties of Medicine, Applied Science and Engineering; Arts & Science and UTSC will include SciNet's space allocation in the appropriate proportion, however all operational costs for the space (on- or off-campus) occupied will be covered by SciNet's operating budget. If SciNet funding or cost recoveries are terminated and operational costs cannot be funded, SciNet must vacate all space and release the allocation.

Proposed Space Allocations

SciNet will consist of two distinct yet connected Capital Projects:

1. HPC Centre (rental premises at 7700 Keele Street);
2. SciNet Administration/Technical Operations/Collaborative Offices in 256 McCaul Street on the St. George Campus;

The SciNet plan is to connect the three HPC systems with the scalable storage to the University of Toronto backbone network in such a way that every system will be accessible from anywhere on the network and thereby accessible to students and faculty across institutions, the province and the country.

HPC Centre

After a year-long search for a suitable site on and off-campus, with available electric power capacity of 3MW to accommodate the High Performance Computing SciNet Centre, a suitable location was found at 7700 Keele Street. The property is located on the south-west corner of Keele St. and Highway 7, in the City of Vaughan, Ontario. Space on the St. George Campus is very limited. This, together with the significant amount of power required for the facility made an on-campus facility impractical.

An Offer to Lease the premises at 7700 Keele Street has been executed by the University and the owners of the property commencing December 1, 2007 for 5 years with an extension of a further 5 years, to be used for the SciNet High Performance Computing Centre.

The lease agreement is for 1,100 square metres of rentable space. Available power for computing will be 2,000 KW and the remainder will be required by the cooling subsystem.

The total cost of rent per the 5 year duration, excluding utility costs is $1,378,126. Please refer to the chart which follows.

HPC Centre Space/Utility Costs

DESCRIPTION	M2	Cost/Sq.M.	COST
RENT CALCULATIONS			
Net rent	1,137	193.77	$ 220,320
GST applicable to net rent		1.98%	$ 4,362
Rent incl gst			$ 224,682
Subtotal Rent 5 years			**$ 1,123,411**
Operating/maint costs/taxes		43.06	$ 48,960
Year 2			$ 49,939
Year 3			$ 50,918
Year 4			$ 51,897
Year 5			$ 52,999
Subtotal gross rent			**$ 1,378,126**
OPERATIONAL EXPENSES			
Penalty rate post 5 years			$60,000
Telephones	400/m+tx		$24,500
Security System & monitoring	2,500/y		$ 12,500
Utility expenses: Fibre 10 G	20,800/m+		$ 1,407,150
Dedicated gigabit separate	5 years		314,800
Back-up 5Mbps ADSL Line	200/m+tx+		$27,900
Utility expenses: hydro yr1			$353,044
yr2			$958,436
yr3			$1,423,261
yr4			$1,572,166
yr5			$1,603,609
Subtotal hydro			$5,910,516
Utility expenses: water for 5 yrs	$5,000/y		$25,000
Mechanical service contracts	$6,000/y		$30,000
Subtotal			7,812,366
Contingency for above	1%		78,000
Total Expenses 5 years			**7,890,366**
Average rent& expenses/year			**$1,853,698/y**

***Variable at each year (must build-in an escalation cost of 2% per subsequent years).**
Realty taxes at $1.50 per square foot are included in the rent to be reimbursed upon exemption.

Minimum Planning Calculations: Racks*

1 rack generates approx. 0.74 NASM (8 NASF)
Including hot and cold aisle 1 rack generates 1.58 NASM (22 NASF)

- Rack height 2.13 meters (84 in)
- Rack width 0.6 meters (2.0 ft)
- Rack depth 1.22 meter (4 ft)
- Hot Aisle 1.22 m (3.0 ft)
- Cold Aisle 1.22 m (4.0 ft)

** Please note that these are minimum planning dimensions which are to be confirmed by the manufacturer's specification once the equipment has been selected*

Computer Cluster

The large computer systems at the Keele Street site will comprise 110 standard racks of computer equipment with an average power-load of 19kW. Much of the required cooling and power infrastructure will be co-located with the cluster, e.g., with the APC data centre design there will be 96 "RC" in-line cooling units (each a half-rack wide), 16 Remote Power Panels (RPPs; 2 racks wide) and 9 Cooling Distribution Units (CDUs) in the computer room.

The computational systems will consist of the "capacity" and "capability" clusters, the parallel vector machine, and the scalable mass storage. The clusters differ mainly by the type of networking used for their node interconnects (e.g. gigabit ethernet for the capacity cluster and InfiniBand for the capability nodes). Memory and CPU characteristics may vary between the nodes in order to maximize usefulness for all researchers. The combined cluster is expected to comprise at least 20,000 cores with a peak theoretical speed that will exceed 160 TFlops.

The parallel vector system will consist of a maximum of 10 NEC SX9 nodes, configured in 20 standard racks. The total amount of power for the vector system will be 300kW at its peak capacity. It will require forced-air cooling from the bottom, and thus will be installed on a raised platform to allow for the necessary air flow.

The total power requirement for all computing equipment and associated power distribution and local cooling equipment will not exceed 2,000 KW.

HPC Space Allocation

DESCRIPTION	ALLOCATION	DETAILS	FTE	NASM
HPC FACILITY TOTAL	**2.0**		**2.0**	**1,100.0**
Assignable space				
Mechanical space				
Electrical space				
Loading Bay				
Trailer space				
STAFF			**2.0**	**35.0**
Technical Staff	13 NASM x 2	Open Offices	2.0	26.0

DESCRIPTION	ALLOCATION	DETAILS	FTE	NASM
EQUIPMENT	**1900 kW**	**110 racks**		**min 216**
Clusters	1440 kW	56 racks		
Parallel Vector	300 kW	20 racks		
Scalable Storage & Networking	160 kW	24 racks		

Administration and Technical Operations

The SciNet proposes to have the Administration/Technical Operations/Collaborative Offices in 256 McCaul Street on the St. George Campus.

As SciNet will be operating three distinct computer systems as well as providing support to non-U of T users in the context of our commitment to Compute Canada through the NPF process, there exists a requirement that SciNet be adequately staffed. In the context of the original NPF proposal to CFI and the linked proposals to the province, SciNet explicitly envisioned a staff complement of 17.5 persons. This might be most usefully compared to the staffing level at our sister Ontario consortium HPCVL that is led by Queen's University and which includes the University of Ottawa, Carleton University, RMC and Ryerson University. HPCVL runs one major (SUN) system located at Queen's and currently has 13 FTE employees, and is about to hire two more persons. Since HPCVL is the smallest of the two existing central Canadian consortia, its experience with staffing level requirements would appear to provide a lower bound estimate of the required SciNet level. Detailed justification of the following numbers has been provided in the round 2 application to the ORF that was submitted in mid-June 2007. The envisioned steady-state staffing level would be built-up over a period of approximately 2 years.

The Staff Complement will include the following:

- Scientific Director - .5 FTE
  A faculty member with 50% time dedicated to SciNet for five years. Also responsible as SciNet member of the NIC and member of the CC BOD.

- Chief Operating Officer – 1 FTE
  One qualified scientist or engineer with significant HPC experience, 100% time for five years inclusive of benefits and annual increases; responsible for oversight of day-to-day operations.

- Financial/Administrative Officer – 1 FTE
  Main administrative co-ordinator; 100% time for five years inclusive of benefits and annual increases; responsible for financial and administrative operations.

- Communications/Admin Support – 1 FTE
  Responsible for newsletters, web site content, maintaining data base of large computational projects and general clerical support

- System Administrator – 6 FTE – (2 persons per computer system)

Two systems administrators primarily dedicated to each of the three computer architectures (capacity, capability and vector), responsible for all aspects of systems operation (e.g. installing hardwares and software, performing upgrades, creating user accounts, etc.); salary consistent with current standards; costs may vary due to rate of ramp-up and annual adjustments.

- Technical Analysts – 6 FTE
  Minimum number required to support user base; interact closely with researchers to develop, port and optimize numerical codes to work as effectively as possible on SciNet systems; salary consistent with current standards; costs may vary due to rate of ramp-up and annual adjustments.

- Technicians - 1 FTE
  Supports System Administrators in maintaining and fixing hardware; ensures systems are kept running; deals with vendors to facilitate repairs.

- Training Coordinator - 1 FTE
  Responsible for developing training material and courses (classroom and online) for local and remote users (e.g. usage of systems, parallel programming, optimization methods, etc.).

Significant staffing is required to ensure that SciNet resources are utilized and managed as effectively and efficiently as possible.

Critical to the success of SciNet is a dedicated and effective management team (4.5 FTEs) that is responsible for daily operations, plans future growth and coordinates activities with provincial and national organizations as well as other consortia. The administrators will interact closely with the technical analysts in order to maximize performance and usability of the systems.
Most of the SciNet personnel will interact regularly with colleagues at other consortia (as part of TECC working groups, attending or teaching remote classes, coordinating system use for large projects, etc.) and will require a dedicated AccessGrid-enabled conference room.

Space will be needed for visitors, interaction with local researchers, visualization systems and 3-4 racks of computer equipment (servers, storage, backups).

Office Space Allocation

DESCRIPTION	ALLOCATION	DETAILS	FTE	NASM
STAFF (TOTAL) SciNet			**17.51**	
STAFF in HPC Space			**2.0**	**26.0**
TOTAL MAIN OFFICE			**17.51**	**265.0**
STAFF in MAIN OFFICE			**17.51**	**175.0**
SCINET Scientific Director	Tenure Faculty	Faculty Office	0.51	18.0
Chief Operating Officer	New Staff	Private Office	1.0	13.0
Training/Coordinator	New Staff	Private Office	1.0	13.0
Financial Administrator	New Staff	Private Office	1.0	13.0
Clerical	New Staff	Open office	1.0	13.0

DESCRIPTION	ALLOCATION	DETAILS	FTE	NASM
Reception area	n.a	n.a		4.0
Technical Staff: systems admin	New Staff	8 NASM x 5	5.0	40.0
Technical Staff: Analyst	New Staff	8 NASM x 6	6.0	48.0
Visitors shared office		8 NASM x 2		13.0
Support Space				**90.0**
Storage				10.0
Small meeting room		3 seats		10.0
kitchenette				10.0
Access Grid Room		24 seats	24 x 2	48.0
Computer Equipment Room		4 racks x 0.6		12.0

The nominal amount of space required by SciNet is 265 NASM.

Main Offices Operational Costs

OPERATIONAL EXPENSES	NASM	$/NASM	COST
Space costs for 254/256 McCaul Street Including heat/hydro/cooling/cleaning	**320**	$63,474.00	$317,370
Telephones	1,800/m+tx		$118,800
Security System & monitoring	2,500/y		$ 12,500
Utility expenses: fibre	10,000		$10,000
Utility expenses: CNS	7,000/oto		$ 7,139
Total Expenses 5 years			**$465,809**

VI. ENVIRONMENTAL IMPACT

All construction for Phase II shall be done in accordance with the University's *Environmental Protection Policy* adopted March 7, 1994. Based on the EPP, all matters related to the project shall follow these principles:

It shall be used to make optimum environmental decisions;
It shall be considered in the selection of consultants;
It shall be used in making decisions on design, processes and products

While the EPP Checklist is to be used as a guide, the reference philosophy that represents the commitment to responsible property development by the Faculty of Arts & Science shall be reflected in all aspects of the project.

Responsible Property Development shall be defined as strategic relationships that balance the interests of: Economic Responsibility, working within the budget and within the schedule for the project; Equity with respect to space relationships, wages/fair trade, accessibility and mobility, safety and well-being for the occupants and visitors; and Ecology, so that the project's impact will be sustainable within the natural environment and within its context and contribute to community-building within existing University fabric.

The Implementation Plan strategies are to include the following in order of importance:

Natural light:

- for all work spaces as the existing conditions permit;
- use energy-efficient lighting fixtures (T8, T5 or better)

Any interior materials that are required to be selected shall adhere to the following:

- materials that are a result of low-emission manufacturing;
- a supply chain management that ensure the use of local materials, manufactured locally or transported in mass efficient manner;
- buy only material from fair/wage/trade companies with a recognized designation of energy conservation;
- use labeled green products;
- use high recycle content products;
- use low-life impact products;
- use closed-loop re-usable products;
- use non-voc content products;
- Furnishings, equipment and all other incidentals shall be purchased using a triple-balance matrix.

See Appendix 'A' for Environmental Design Standards and Checklist.

VII. SPECIAL CONSIDERATIONS

Accessibility

a) HPC Centre
Unit #6 at 7700 Keele Street is a one storey space, accessible from street level.

b) SciNet Offices
256 McCaul Street, the proposed location for the SciNet offices, is a fully accessible building.

Security

a) HPC Centre
An intrusion alarm system shall be installed in the unit.

b) SciNet Offices
This section is not applicable to this portion of the project.

Deferred Maintenance

a) HPC Centre
This section is not applicable to this portion of the project.

b) SciNet Offices
The area proposed to be occupied by SciNet on the 2nd floor of 256 McCaul Street has the following identified deferred maintenance:

- The existing Fire alarm panel has no spare spaces and therefore additional input zones are required;
- The Central emergency light battery unit is old and non-compliant to current codes, and therefore it must be replaced.

Telecommunications and Network Connections

a) HPC Centre
The HPC Centre requires a 10 Gbps main network to campus (refer to table 5.2.1A). In addition, a backup 5 Mbps ADSL line and 4 (standard) phone lines are required.

b) SciNet Offices
The SciNet offices require 18 standard phone lines, a Gigbit network to U of T and a Gigabit dedicated to HPC Centre.

AV Infrastructure

a) HPC Centre
This section is not applicable to this portion of the project.

b) SciNet Offices
The Access Grid Room is to be built with state-of-the-art AV equipment to allow remote collaborative meetings, presentations and real-time collaboration on research projects.

The room will be able to support video and audio conferencing capability, simultaneous presentations and live-webcasting. It will be equipped with wireless connectivity to the University Standard access.

The equipment will include two plasma 52" minimum flat panel screens and video conferencing switch equipment, digital recording, amplifier and speaker system with wireless microphones. The room will be equipped with multiple digital recording pan/tilt/zoom cameras to capture collaborative meetings and presentations.

In addition, the room will be equipped with two digital projectors, ceiling mounted with electronic screens.

The lighting system and all equipment will be managed by an integrative "Creston" control system which will be also able to split the digital projection, audio, and lighting systems into a bisected space into two Access Grid Room sections. All equipment racks will be serviced from the corridor and accessed within the room in order to not disturb room occupancy. The room will be equipped with a built-in computer, programmed to be ready to activate presentations with minimal AV technical assistance.

The room will be equipped with an electronic wall separator which will provide visual and acoustical separation of each half.

The AV system will be provided outside of the capital budget outlined in this report.

Campus Planning

The renovations to 256 McCaul Street are minor and fully contained within the building. There are no campus planning issues.

Operating Costs

a) HPC Centre
The net and gross rents and all the operational costs for this facility for the rental premises for SciNet are estimated to be approximately $7,329,905 for the 5-year term of the grant.

b) SciNet Offices
The total operating costs for the on-campus SciNet offices are estimated to be approximately $465,809 for the 5-year term of the grant.

VIII. RESOURCE IMPLICATIONS

Capital Cost Estimates

Two total project cost estimates have been determined addressing the expenses associated with renovations for each location.

The facility at 7700 Keele Street, accommodating the High Performance Computing SciNet Centre is estimated to cost approximately $4,771,970.

Renovations to the portion of the second floor of 256 McCaul Street assigned to the SciNet administrative unit have been estimated to cost $1,110,620.

The total cost of both portions of the project as recommended by the Project Planning Committee is $5,882,590.

The balance of the funding for capital expenditures is directed towards the purchase of equipment. Participating divisions will cover any shortfall in funding.

IX. FUNDING SOURCES AND CASH FLOW ANALYSIS

The project must respond to the requirements set out in the application to the Canada Foundation for Innovation and all conditions of the award. There are 5 special conditions, beyond the normal program requirements, associated with the CFI award - addressing governance and management at the national level:

1. Separation of CCC governance and management
2. Establishment of an independent Chair of the CCC Board
3. Appointment of an Executive Director
4. Creation of a mechanism to interact with the user community
5. Establishment of a resource allocation process

The funding sources for the capital expenditures (only) of the project are as follows:

Canada Foundation for Innovation	$15,000,000
Province of Ontario	$15,000,000
Vendor deep discounts	$ TBD
University of Toronto	$2,850,000
Faculty Arts & Science ($1,800,000)	
Faculty of Medicine ($450,000)	
Faculty of AS & E ($450,000)	
UTSC ($150,000)	
Total:	$32,850,000

Of the $32.85 million identified for capital expenditures, $5,882,590 is the total project cost estimated for renovations. The balance of the capital budget is directed towards the purchase of equipment.

Operating Funds:

Ontario Research Fund- Research Excellence	$ 8,000,000 (application submitted)
CFI Infrastructure Operating Fund*	$ 4,500,000 (confirmed)
Federal Granting Council*	$ 1,125,000 (confirmed)
Natural Sciences and Engineering	
University of Toronto	$2,375,000 (confirmed)
Faculty Arts & Science ($1,500,000)	
Faculty of Medicine ($375,000)	
Faculty of AS & E ($375,000)	
UTSC ($125,000)	
Natural Science & Research Council*	$130,000 (operating)

* funds cannot be applied against net rental expenses

X. SCHEDULE

a) HPC Centre

AFD Application Space Licence	June 2007
Tender	January 2008
Construction complete 7700 Keele	August 2008
Occupancy	September 2008

b) SciNet Offices

Tender	January 2008
Construction complete 256 McCaul	June 2008
Occupancy	July 2008

XI. RECOMMENDATIONS

That the Planning and Budget Committee recommends to the Academic Board:

1. THAT the Project Planning Report for the Sci Net project be approved in principle.

2. THAT the project scope for leasehold improvements at 7700 Keele Street consisting of 1,100 square metres with a total project cost of $4,771,970 be approved.

3. THAT the project scope for 256 McCaul Street of approximately 320 net assignable square metres with a total project cost of $1,110,620 be approved.

Appendix A – Total Project Cost Estimates

Total Project Cost

Project Title:	256 McCaul SciNet facility		
	Preliminary Draft estimate		
TABLE 1: Total Project Cost Estimates			**notes**
Total estimated construction amount	$688,000		430 NSM @ $160
Construction contingency	$68,800		
Applicable GST	$14,985		
Total including GST	$771,785		
Infrastructure Upgrades in Sector	na		
Secondary projects	na		
Hazardous Materials	$25,000		allow
Landscaping	na		
Permits & Insurance	$2,000		
Professional Fees	$127,344		
Computing Infrastructure	$10,000		allow
Telephone set & install	$6,000		allow 20
Audio/Visual	na		
Moving	na		
Staging	na		
Furnishings: Department	$80,000		
Furnishings: Classrooms	na		
Equipment	$0		
Security & access systems	$25,000		card access
Signage: Interior & Exterior	$0		
Signage: Donor Recognition	$2,000		
Groundbreaking & Building opening	$5,000		
Miscellaneous	$3,000		
Project Contingency	$31,714		
Finance Costs	$21,777		allowance
Total Project Cost Estimate incl GST	**$1,110,620**		

prepared 24th July 2007 jcb

Project Title:	7700 Keele SciNet facility		
	Preliminary Draft estimate		
TABLE 1: Total Project Cost Estimates			**notes**
Total estimated construction amount	$3,215,000		based on original CMRR estimate
Construction contingency	$482,250		
Applicable GST	$73,206		
Total including GST	$3,770,456		
Infrastructure Upgrades in Sector	na		
Secondary projects	na		
Hazardous Materials	$0		
Landscaping	na		
Permits & Insurance	$5,000		
Professional Fees	$678,682		
Computing Infrastructure	$0		
Telephone set & install	$3,000		
Audio/Visual	na		
Moving	na		
Staging	na		
Furnishings: Department	$25,000		
Furnishings: Classrooms	na		
Equipment	$0		
Security & access systems	$50,000		alarm system & link
Signage: Interior & Exterior	$0		
Signage: Donor Recognition	$2,000		
Groundbreaking & Building opening	$5,000		
Miscellaneous	$3,000		
Project Contingency	$136,264		
Finance Costs	$93,568		allowance
Total Project Cost Estimate incl GST	**$4,771,970**		

revised 24th July 2007 jcb