



Office of the Assistant Vice-President, Campus and Facilities Planning

**TO:** Planning and Budget Committee

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**AGENDA ITEM:** 6

**ITEM IDENTIFICATION:**

The Project Planning Report for the SciNet High Performance Computing (HPC) Project at the University of Toronto

**JURISDICTIONAL INFORMATION:**

Under the Policy on Capital Planning and Capital Projects, the Planning & Budget Committee reviews Project Planning Reports prepared for a capital project and recommends to the Academic Board approval in principle of the project.

**BACKGROUND:**

In 1999, the Canadian Foundation for Innovation (CFI) and the provincial government helped fund the establishment of the Physical Sciences Computing NETWORK (PSciNet) at the University of Toronto. This funding of \$7.38 million was granted to a group of researchers from the Canadian Institute for Theoretical Astrophysics, the Department of Chemistry and the Department of Physics. These funds allowed the acquisition of three distinct computer systems; each one designed to serve the special needs of each collaborating group and to be independently operated by each group.

In 2003, additional CFI funding of \$11.20 million allowed for the participation of the additional researchers from the Department of Physics, the University of Toronto Institute for Aerospace Studies, and the Department of Mechanical and Industrial Engineering. This funding secured two new cluster systems as well as an upgrade to the existing vector system. The newly named "SciNet" has been developed through the continuing collaboration of the previously involved groups, joined by investigators from computational biology, genomics and bioinformatics.

The latest CFI and provincial grants (totaling \$30.0 million) will allow a significant increase in SciNet's computing capabilities. The proposed new SciNet systems will be operated as an integrated resource that will be widely accessible not only to members of the University of Toronto community (Faculty of Medicine and affiliated teaching/research hospitals, Faculty of Applied Science and Engineering, Faculty of Arts & Science and UTSC) but also to other researchers from the wider Canadian community.

The current SciNet expansion has been funded by CFI's National Platform Fund (NPF) and the Province of Ontario. SciNet is expected to be the most powerful academic HPC facility in Canada.

This tremendous new computing capability will enable ground-breaking research across the entire range of disciplines that are 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. The concentration of users of this facility at the University of Toronto has enabled it to become a local facility.

### **HIGHLIGHTS:**

The space and power requirements for the installation and operation of the envisioned computing arrays are considerable. The cost of power required for the facility would be prohibitive if located on campus. Using existing power supplies would severely limit other academic activities. Similarly, no on-campus space suitable to accommodate the hardware computing is available. The costs associated with vacating space and subsequent secondary effects also make the proposition impractical. After an extensive search and investigation of several possible sites, both on the University of Toronto campuses and off-campus, the Project Planning Committee concluded that the most cost-effective option was to lease suitable space for the HPC portion of the project and to accommodate SciNet's administrative and technical facilities on the St. George Campus.

Accordingly, the University has secured approximately 1,100 square metres (11,840 square feet) of net rentable space in a building at 7700 Keele Street. This location will be able to accommodate all the proposed computer hardware and infrastructure, and can provide up to 3MW of electrical power that is needed to operate the HPC hardware and associated cooling equipment. Significant leasehold improvements will be required to accommodate the anticipated computer hardware, HVAC equipment, and support facilities. The cost of the leasehold improvements is less expensive than providing an on-campus facility fully fitted-up for this purpose.

The terms of the lease agreement have been co-ordinated to meet the current five-year funding program with an option to extend for another five years if additional funding is secured. The goal is to commence operations in April 2008 with a significant portion (25%) of the final computing capacity installed and operational. The remainder of the systems will be purchased and installed in the following two years.

Due to the above lease agreement, the SciNet Capital Project consists of two parts. While the hardware will be located off-campus, the SciNet administrative and technical operations will be located on the St. George Campus in order to be close to the consortium's researchers. These facilities will consist of an AccessGrid room (that connects SciNet with all of the other Compute Canada consortia) and offices that will be located on the second floor of 256 McCaul Street (approximately 320 nasm).

This on-campus location will ensure that the SciNet resources are utilized and managed effectively and efficiently, 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 and advanced scientific professionals 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 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 location's AccessGrid facility will enable remote conferencing and collaboration between the researchers on the St. George Campus and their peers at other campuses and institutions.

**RESOURCE IMPLICATIONS:**

**Capital Cost Estimate**

The total capital project cost for the SciNet Project is estimated to be \$5.882 million. Of this total, approximately \$4.772 million is attributable to leasehold improvements at 7700 Keele Street and approximately \$1.111 million is attributable to the renovations at 256 McCaul Street

The capital expenditures of the project (7700 Keele Street and 256 McCaul Street) will be part of the larger SciNet capital budget which is funded 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)

Of the \$32.5 million identified for capital expenditures, \$5.882 million is the total project cost for renovations. The balance of the capital budget is directed towards the purchase of equipment.

The HPC Centre at 7700 Keele Street is projected to have a total operating cost of approximately \$7,890,360 for the five-year term. The operating expenses for SciNet's main offices at 256 McCaul Street are expected to be approximately \$465,810 for a five-year term. These costs are fully funded within the grant funding received for this project, as outlined below:

The operating costs of SciNet will be carried as follows:

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)

\* These funds cannot be applied against net rental expenses

The participating divisions will cover any shortfall in funding. No borrowing is required for capital or operating expenses.

#### **SCHEDULE:**

With approval of this recommendation, and immediate implementation, the Keele Street facility will be operational by September, 2008.

Implementation of renovations at the McCaul Street site will provide occupancy by July 2008.

#### **RECOMMENDATIONS:**

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

1. THAT the Project Planning Report for the SciNet 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.