Annual Progress Report

Date submitted (dd/mm/yyyy): 20/09/2013  Project no.: 30198

Institution: University of Western Ontario

Title of the Major Science Initiative (MSI): Compute Canada / Calcul Canada

Signatures:

By signing below, you acknowledge having received and read a copy of this report and further certify that all information incorporated in the document is true, accurate, and complete, and that MSI Board members have seen and approved the report.

Chair of the MSI Board
Name: Donald Hathaway

Signature: [Signature]
Date: September 20, 2013

President or authorized signatory of MSI lead institution
Name: Jill Kowalchuk

Signature: [Signature]
Date: September 20, 2013

NSERC/MRS principal investigator, where applicable
Name: David Sénéchal

Signature: [Signature]
Date: September 20, 2013
Part 1 – Performance report

1. Summary of performance indicators for the MSI

<table>
<thead>
<tr>
<th>Standard indicator</th>
<th>Target for 2012</th>
<th>Value of indicator for 2012</th>
<th>Target for 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Users (1)</td>
<td>1,200</td>
<td>1,452</td>
<td>1,500</td>
</tr>
<tr>
<td>Number of HQP (2)</td>
<td>4,000</td>
<td>3,408</td>
<td>3,850</td>
</tr>
<tr>
<td>Number of scientific contributions (e.g., journal publications, conference proceedings, etc.) linked to the use of the MSI. See Appendix A</td>
<td>1,500</td>
<td>1,411</td>
<td>1,550</td>
</tr>
<tr>
<td>Number of technical contributions (e.g., patents filed, spin offs, etc.), where applicable, linked to the use of the MSI. See Appendix B</td>
<td>500</td>
<td>943</td>
<td>950</td>
</tr>
<tr>
<td>Level of use (of all compute systems in Compute Canada)</td>
<td>75%</td>
<td>81.76%</td>
<td>80%</td>
</tr>
<tr>
<td>User satisfaction (based on a 5 point scale with 5 being very satisfied) (3)</td>
<td>3.5</td>
<td>4.13</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MSI specific indicators</th>
<th>Target for 2012</th>
<th>Value of indicator for 2012</th>
<th>Target for 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up time of compute systems (4)</td>
<td>98%</td>
<td>98.45%</td>
<td>98%</td>
</tr>
<tr>
<td>Number of HQP who completed training (graduated in the specified time period) (5)</td>
<td>500</td>
<td>467</td>
<td>500</td>
</tr>
<tr>
<td>Number of people trained/reached through training or outreach activities. See Appendix C</td>
<td>3,000</td>
<td>4,802</td>
<td>5,400</td>
</tr>
<tr>
<td>% of overall FTE time spent on non-technical or non-scientific activities (6)</td>
<td>10%</td>
<td>7.1%</td>
<td>10%</td>
</tr>
</tbody>
</table>

(1) Users includes all individuals using the facility who are faculty members.
(2) HQP includes students, post-doctoral fellows, technicians, research associates, professionals (as defined in the report question)
(3) As reported by all individuals who responded to the survey. Going forward this will be integrated directly into the Compute Canada renewal system allowing for a broader sampling of individuals.
(4) Includes all systems managed by Compute Canada.
(5) Compute Canada started collecting this information in 2012 for all students, PDFs, research associates, etc that were registered in CCDB since 2010. Compute Canada did not request that this only be completed for a given period. As such, the statistic was averaged over a 3 and a half-year period for the purposes of this report.
(6) This measures the number of individuals and the overall percentage of time spent on non-technical or scientific activities including administration, HR and other responsibilities. This shows that Compute Canada resources are focused on maintaining the infrastructure and supporting the users.
Guiding principles for PIs:

Should include no more than 10-12 indicators (including standard and specific).

Indicators should be:
- “Collectable”
- Measurable (quantitatively or qualitatively)
- Useful/actionable
- Standardizable within the international community --- comparable
- Clearly defined

Selected indicators will cover the key activities of the MSI (operations and research) as well as their outputs & outcomes. This could include:
- Access, for example, number or success rate of access requests
- Capacity and use, for example, level of use (use delivered vs availability of infrastructure), number & growth in users, user retention, user satisfaction
- Quality/Reliability, for example, total time lost from unplanned events
- Finance/Sustainability, for example, leveraging of funds (through ratios such as CFI or CFI+MRS contribution/total O&M funding; revenues from industry/total funding), cost-recovery ratio, etc.
- Training (could overlap use)
- Research activity/productivity, for example, number of distinct research projects enabled, number of publications in peer-reviewed journals, number of new partnerships between the MSI and outside organizations, number of direct participation by MSI or its employees in formal collaborations/networks/consortia at the national and international level, number of projects with public or private sector participants, number of international faculty and students involved in MSI projects (speaks to international reputation?)…
- Outcomes: number of patents, number of jobs created

MSIs will be allowed to discuss if they wish to do so any issues raised by the measure(s) including deviation from expected performance contingencies and corrective actions.
i. Please provide information regarding the distribution of Users* of the MSI during the period extending from April 1, 2012 to March 31, 2013 and compare it to that of the previous year including the proportion of new users. Disaggregated data should allow assessing the use of the facility among researchers:

* within and outside of Canada,
* from within and outside the MSI,
* from different sectors (academic and non-academic organizations),
* and from various disciplines.

* Students, post-doctoral fellows, technical and professional personnel should not be included in this section.
<table>
<thead>
<tr>
<th></th>
<th>Number of Users (Faculty)</th>
<th>Usage: Core Years (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>within Canada</td>
<td></td>
<td></td>
</tr>
<tr>
<td>outside Canada (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>within the MSI (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>outside the MSI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>1163</td>
<td>1373</td>
</tr>
<tr>
<td>College</td>
<td>34</td>
<td>44</td>
</tr>
<tr>
<td>Private Industry</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Government Agency/Lab</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Not-for-profit</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Hospital</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>Disciplines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astronomy</td>
<td>37</td>
<td>45</td>
</tr>
<tr>
<td>Biological and Life Sciences</td>
<td>144</td>
<td>177</td>
</tr>
<tr>
<td>Business</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Chemistry and Biochemistry</td>
<td>196</td>
<td>229</td>
</tr>
<tr>
<td>Computer and Information Science</td>
<td>116</td>
<td>124</td>
</tr>
<tr>
<td>Engineering</td>
<td>264</td>
<td>316</td>
</tr>
<tr>
<td>Environmental and Earth Science</td>
<td>101</td>
<td>106</td>
</tr>
<tr>
<td>Humanities</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td>91</td>
<td>97</td>
</tr>
<tr>
<td>Medical Science</td>
<td>43</td>
<td>66</td>
</tr>
<tr>
<td>Physics</td>
<td>194</td>
<td>236</td>
</tr>
<tr>
<td>Psychology</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Social Science</td>
<td>18</td>
<td>26</td>
</tr>
</tbody>
</table>

(1) Compute Canada policy only supports international users if supported by a Principal Investigator (PI) that is a Faculty Member of a Canadian institution. The number of users and associated compute system usage is tracked by PI for the entire group. Compute Canada systems are used by international users, but this is not shown in this group.

(2) “Within the MSI” is defined as users (faculty members) whose primary affiliation is with a university that is a Member of Compute Canada. In 2012-13 Compute Canada had 28 Members including: Concorida
Classification of users in the above categories is dependent upon how researchers classify themselves in the central Compute Canada Database Portal (CCDB). Before 2012 researchers were only eligible to hold a “Principal Investigator” account (in which they could approve other students, PDFs, external collaborators and researchers working under them) if they were a faculty member at a CFI or Tri-council eligible institution. As such, researchers who would normally deem their primary affiliation to be a hospital or research institute are classified within a University because they listed their adjunct position in CCDB to get access to the resources. This policy has since been changed, and we are working to ensure that individuals are classified by their most appropriate primary affiliation. This update will be reflected in future statistics.

The change in policy also explains the significant increase in usage of the systems by PIs from government labs. Some researchers have been reclassified as their primary affiliation is from a government lab. In addition, more researchers from government labs have started to take advantage of the resources in their research projects.

Similar challenges existing in classifying users in a specific discipline. The disciplines noted above were used from the NSERC categorization for historical reasons.

The majority of the usage of Compute Canada systems is from within the traditional fields of Chemistry, Biochemistry and Physics. However, we are seeing a significant increase in usage by individuals in “non-traditional” disciplines such as Business and Life Sciences. There is also a significant increase in Engineering and Computer Science, which is attributed to a number of these researchers utilizing the Compute Canada infrastructure while working with collaborators in non-traditional disciplines.
Please compare the current level of use by HQP to that of the previous year including the proportion of new HQP? If possible, disaggregated the data by category of HQP as follows:

- Students
- Post-doctoral fellows
- Technical and professional personnel

<table>
<thead>
<tr>
<th></th>
<th>Number of Users</th>
<th>Usage: Core Years (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>Students</td>
<td>1763</td>
<td>2406</td>
</tr>
<tr>
<td>Post-doctoral fellows</td>
<td>419</td>
<td>519</td>
</tr>
<tr>
<td>Technical &amp; Professional Personnel</td>
<td>282</td>
<td>336</td>
</tr>
</tbody>
</table>

ii. Please describe any national or international recognition the MSI has gained during the period extending from April 1, 2012 to March 31, 2013.

During the period of April 1, 2012 to March 31, 2013, an emphasis was placed on reinforcing national recognition and engagement within Canada’s research and innovation-driven communities. This was done to lay the groundwork for Compute Canada to develop a more comprehensive, long-term campaign, once its full senior leadership team is in place, that will further expand and strengthen Compute Canada’s visibility and recognition as a national and international leader in the delivery and support of advanced computing for research.

Compute Canada’s greatest national recognition comes from its annual conference, the High Performance Computing Symposium, Canada’s foremost supercomputing conference. In May last year, HPCS 2012 was hosted alongside BCNET’s annual network conference in Vancouver, BC and attracted one of its largest audiences to date from across North America. Xyratex, a Compute Canada industry partner and conference sponsor, was blogging live from the event and posted: “The three day Symposium looks to be an exciting one with close to 500 high profile delegates from various disciplines within the research and HPC communities.” Following the event, the attendee evaluation forms indicated nearly 30% of respondents felt the event exceeded their expectations. Similarly, one delegate left this comment regarding HPCS’s Day Three Keynote speaker, John Towns, Principal Investigator of the National Science Foundation’s Extreme Science and Engineering Discovery Environment (XSEDE) project: “It was the best presentation and most informative about how the CyberInfrastructure and HPC have changed over the past decades.” Shortly after participating in the HPCS event, John Towns accepted an invitation to join the Compute Canada’s Board of Directors, which was a significant and positive step forward in building a collaborative relationship between Canada and the United States’ national HPC organizations.
Compute Canada's annual allocation of advanced computing resources has also attracted both national and international recognition. HPCwire, an international online source for HPC news, analysis and information, published a full-page story on Compute Canada's 2012 allocation of nearly $72 million worth of state-of-the-art computing, storage, and support resources to 212 leading edge Canadian research projects across the country (http://www.hpcwire.com/hpcwire/2013-01-21/compute_canada_awards_$72_million_for_research_projects.html).

Major research discoveries and science breakthroughs regularly contribute towards the national recognition of Compute Canada's distributed platform of resources. They also demonstrate the important role the Regional Divisions play as the front-line representatives of Compute Canada through their local support teams and operation of regional computing facilities. For example, last year’s confirmed discovery of a Higgs boson-like particle in July 2012 gained significant national and international media attention. Canadian researchers played a key role in the milestone discovery through their use of various regional Compute Canada facilities. Mainstream and university media outlets across the country published a number of stories highlighting ATLAS-Canada researchers’ use of regional national platform sites, such as those provided by Calcul Quebec (http://publications.mcgill.ca/reporter/2012/07/mcgill-physicists-contribute-to-sighting-of-what-could-be-the-elusive-higgs-boson/), SciNet (http://www.thestar.com/news/world/2012/07/03/higgs_boson_university_of_toronto_plays_key_role_in_god_particle_discovery_expected_to_be_announced_wednesday.html), and WestGrid (http://www.sfu.ca/sfunews/stories/2012/sfus-role-in-the-atlas-experiment.html).

Other Compute Canada-supported discoveries which received national recognition last year included examples such as Ryerson University’s Seth Dworkin who is using SciNet facilities to develop greener and cleaner engine technology (http://theeyeopener.com/2013/04/supercomputing-to-save-the-planet/), and researchers Alan Wagner and Humaira Kamal who used WestGrid clusters to execute over 100 Million MPI processes to scale basic MPI middleware for massively parallel programming, a groundbreaking milestone in the exploration of exascale computing (and an announcement which was picked up and shared by the Argonne National Lab - http://www.mpich.org/2013/01/15/over-100-million-processes-with-mpich/).

In March 2012, Backbone Magazine, one of Canada’s largest and most successful business magazines, ran a special edition to recognize the organizations, people, events and products that stand out and contribute to Canada’s competitiveness and economic strengths. As part of this showcase, one of Compute Canada’s regional division facilities (HPCVL) was selected as one of the "Best 10 Research Facilities" in Canada. (http://www.backbonemag.com/Magazine/2013-03/backbone200-best-canadian-tech.aspx). Also, three major Canadian research organizations (the Canadian Light Source, SNOLAB, and TRIUMF) -- who heavily rely on access to Compute Canada resources to conduct their world-class research -- were also included in the list. This highlighted not only Compute Canada’s value as a national resource provider, but also how a number of...
Canada’s major research investigation and international collaborations are dependent on access to Compute Canada’s leading edge advanced computing resources.

The value of Compute Canada’s advanced computing resources received provincial government recognition in Quebec as part of a discussion paper produced by the Ministry of Higher Education, Research, Science and Technology from a national conference on research and innovation held in Quebec April 2013. Titled, Assises nationales de la recherche et de l’innovation, the piece referenced the importance of Calcul Quebec in the following quote: “The creation of major infrastructure and research platforms, such as Génome Québec and Calcul Québec, allows the development of cutting-edge research in domains that are key for Quebec.”

(http://www.mesrst.gouv.qc.ca/fileadmin/administration/librairies/documents/RST/Assises/assises_cahier_participant.pdf)

In addition to the above examples, a number of Compute Canada collaborations and activities beyond Canadian borders served to specifically build the organization’s international recognition. For example, in June 2012, Compute Canada was invited to participate in the International SuperComputing (ISC) Conference in Germany. Booth space alongside 175 of the world’s leading HPC vendors and research organizations was provided free of charge as the ISC wanted Compute Canada to promote its Canadian HPC activities to ISC’s 2,000 international delegates. The event was very successful for the Compute Canada contingent, who gained greater insights into a number of up-and-coming HPC projects, technologies and trends. In addition to ISC, Compute Canada also participated in more than a dozen high-profile international conferences, workshops and symposia (see page 12 for a complete list). Further exploration into international partnerships and collaboration opportunities will receive greater emphasis in the coming years.
Past year achievements (activities, successes and challenges) during the period extending from April 1, 2012 to March 31, 2013.

A. Governance and strategy

With reference to the Strategic and Management Plans, please provide an update relative to specific objectives and targets last approved by the MSI Board:

A1. Based on the MSI’s performance during the period extending from April 1, 2012 to March 31, 2013, please list the key strategic objectives and targets that were approved and indicate if they were met. If an objective or target was not met or only partially met, the report should discuss the challenges faced and note any corrective actions taken or planned.

Strategic Objective #1:

Objective: Form an advisory committee on governance and management to review Compute Canada and provide a strategic report with recommendations for strategically moving Compute Canada forward from a governance and management perspective.

Status: Objective met.

Details: Compute Canada created an expert Committee on Governance and Management which met in June 2012. This committee included national and international representatives from industry and academia. The committee delivered a report that contained key recommendations for developing an effective governance and management model for Compute Canada. This report was circulated to the Compute Canada stakeholder community to solicit feedback on the recommendations. Compute Canada also asked for specific feedback from the existing committees and partner institutions. Moving forward the Vice-Presidents (Research), which were operating as an Advisory Board in 2012, pushed forward the incorporation of Compute Canada and the nomination of the inaugural Board of Directors.

Strategic Objective #2:

Objective: Incorporate Compute Canada as a not-for-profit corporation with an independent Board of Directors.

Status: Objective Met.

Details: Compute Canada was incorporated on September 27, 2012 under the Canada Not-for-profit Corporations Act. The VP(R)s defined the eligible membership of the organization as universities and colleges which are CFI eligible and have one or more researchers who have used CC infrastructure in the past 18 months. Compute Canada had 28 inaugural member institutions spanning all regions of Canada. The first special meeting of the Members was held on October 31, 2012 by videoconference at 28 locations across Canada. The inaugural Compute Canada Members Meeting elected the first Board of 10 Directors with an 11th Director added by the Board at the first Board meeting, held November 19, 2012. The list of the Inaugural Compute Canada Board Directors is included in Appendix D.
Strategic Objective #3:

Objective: Hire senior staff - Chief Executive Officer (CEO), Chief Technology Officer (CTO) and Chief Science Officer (CSO).

Status: Partially Met – activities ongoing.

Details: The Advisory Board of VP(R) started a hiring process in August of 2012. Odgers Berndtson was contracted to handle the recruiting process for the three senior positions: the Chief Executive Officer (CEO), Chief Science Officer (CSO) and Chief Technology Officer (CTO). The VP(R) Board started the process for the CEO selection and created a CEO selection committee. 112 individuals applied for the position; 6 candidates were short listed and interviewed by the search committee. A candidate for the CEO position was recommended to the Board in December 2012 and William Appelbe was offered the job. Appelbe started in January 2013 as a contractor. In April 2013, the Board decided that Applebe did not fulfill the competency profile required by the mandate and mission of Compute Canada. At that point he had not yet agreed to the contract on offer. Subsequently an Interim President was seconded from Cybera to provide leadership until a new CEO can be put in place. The advertising and short listing for the CTO and CSO positions was started during the period of this report, but suitable candidates had not been selected by March 31, 2013.

Strategic Objective #4:

Objective: Complete and implement a cost-benefit analysis.

Status: Partially met – activity ongoing.

Details: Compute Canada commissioned a Cost-Benefit Analysis from Hickling Arthurs Low (HAL) with a report submitted to CFI in May 2012. The report contained incorrect assumptions, incomplete and, in some cases, inaccurate data. Compute Canada then decided to develop a cost benefit analysis under the direction of the Executive Director, with the support of Jim Cranston, a consultant who had completed similar work in British Columbia, and a number of key technical people in the regions. This report was delivered to the Compute Canada Board in January 2013. It has been the basis for the Special Committee on Strategy and Planning to undertake extensive consideration of many factors affecting the optimization of the CC facilities and resources. This activity is ongoing and a plan is expected to be complete in early 2014.

A2. If applicable, please describe any major actions taken to enhance or improve the governance of the MSI during the period extending from April 1, 2012 to March 31, 2013. These changes may result from a review of plans, priorities and procedures, unforeseen events, or the adoption of best practices.

The most significant activity undertaken by Compute Canada during the period was the creation of the not-for-profit corporation and the independent Board of Directors. These changes are outlined above and were the result of the adoption of the best practices recommended by the Advisory Committee on Governance and Management. Since the Inaugural Board has been put in place three standing committees of the Board have been created to ensure the effective governance of the organization. Charters have been approved for the Board as a whole and for each standing committee.
The Audit and Disclosure Committee (ADC) has had oversight of the budgetary process, it has selected a Public Auditor and it has implemented the policies and internal financial controls to ensure financial accountability and reporting.

The Governance and Nominations Committee (GNC) has reviewed membership eligibility as defined by the by-laws, it has developed the succession process for Directors and it has taken a lead role in selecting a research council to advise the Board. At the Annual General meeting in October 2013, the Compute Canada Board will recommend that the by-laws be amended to allow research hospitals with one or more researchers who have used a Compute Canada resource in the past 18 months to be eligible for membership in the corporation.

The Management Resources and Compensation Committee (MRC) is responsible for selecting executive-level resources and overseeing their performance.

The Board formed a Special Committee on Strategy and Planning (SPSC) at its January 2013 meeting and this sub-committee, in addition to the deliberations noted in Strategic Objective #4, has operated as an executive committee, often meeting weekly by teleconference and spending many hours resolving the various issues that face every emerging organization.

B. Management

**B1.** If applicable, please describe any major actions taken to enhance or improve the management of the MSI during the period extending from April 1, 2012 to March 31, 2013. These changes may result from a review of plans, priorities and procedures, unforeseen events, or the adoption of best practices.

In April 2012, Compute Canada hired an Interim Executive Director. The Executive Director had the responsibility of supporting the VP(R) Advisory Board in meeting the CFI objectives for funding, while ensuring the Compute Canada network of resources continued operation during the period. Resources both within the regional partners and through contractors employed at Cybera supported the Executive Director. Once Compute Canada was incorporated the Executive Director was given the authority to manage the organization until a CEO was put in place.

To ensure the effective management of the organization, based on the recommendation from the expert governance and management advisory committee, the previous Compute Canada committees were dissolved. Compute Canada created a committee of the regional directors to assist with that the flow of information between the institutions, regions and the national organization.

A significant piece of work during the period was to evaluate and develop solutions for the LEF/NIF/LOF proposals approved by CFI with conditions related to Compute Canada. Compute Canada developed a process for consulting with the researchers and institutions which received these awards. This process improved the management of the MSI.
Throughout the period the process was tested and has been refined with the goal of developing the most effective process for removing the conditions in a timely manner.

C. Users access and training of HQP

C1. Please outline the activities undertaken by the MSI during the period extending from April 1, 2012 to March 31, 2013 to increase the awareness of the potential user communities of the activities and opportunities offered by the MSI.

During the period for this report Compute Canada led activities to increase the awareness of the opportunities that Compute Canada can provide to potential user communities. These activities included meetings with the administration at partner institutions and direct discussions with researchers, mostly through the November 2012 LER/NIF and LOF call for proposals. Meetings with the Research Services offices at more than 25 institutions across Canada promoted Compute Canada services to current and potential research communities. In addition Compute Canada was able to communicate how researchers and institutions can leverage the organization's expertise in housing, managing and acquiring advanced computing infrastructure.

Compute Canada held its annual conference (HPCS 2012) in Vancouver, BC in collaboration with the BCNet annual conference. The co-location enabled exposure with individuals who could potentially use the CC network of resources and/or who would promote its services to other researchers with whom they interact. The BCNet/HPCS 2012 conference had more than 500 attendees from across Canada.

Compute Canada held a total of 29 outreach activities across Canada reaching 1,175 participants (see Appendix C for full listing) in addition to the 500 people who attended HPCS 2012.

Major outreach activities with national or international scope were planned on a national level, and Compute Canada resources allocated based on the likely outcomes in reaching Canadian researchers across disciplines. Therefore HPCS 2012/BCNET was the focus of a substantial national effort and resources during this period, whereas the outreach efforts associated with attending SC 12 were more modest and those for ISC 12 more modest still.

Local outreach opportunities, which ranged from meeting with new faculty hires, through offering departmental or larger training sessions and attending local discipline-specific workshops, were identified by local Compute Canada staff. These were then matched to expertise - typically local technical expertise due in part to funding uncertainty at this time. Events, which had committed resources were supported to take advantage of the opportunity. The largest example is the Summer School run at the University of Sherbrooke in the summer.

The upcoming national Researcher Needs survey will identify national priority areas for outreach; this, coupled with the recently completed HQP survey of technical staff and resulting expertise asset map, will enable more systematically taking advantage of relevant
opportunities. Outreach opportunities that can easily be acted upon by purely local resources will continue to be performed; but outreach opportunities that require national resources to be deployed, such as experts from another region to perform travel, can then be coordinated at a national level.

C2. If applicable, please describe any changes that have been made during the period extending from April 1, 2012 to March 31, 2013 to the MSI’s mechanism for user access and/or to the user fee policy towards the various types of users (e.g., internal or external, academic or non-academic).

There were no significant changes to the mechanism for access to the Compute Canada resources. Users are granted access through the Compute Canada Database Portal (CCDB), which unifies access to the resources nationally. During 2012-13 Compute Canada worked on improvements and enhancements to CCDB and access to the national network of resources.

The most significant change to CCDB was the deployment of the account renewal process. This process requires each registered user (both principal investigator (PI) or sponsored user) to confirm and renew their account. During this process PIs are required to report on results for the given period, thus allowing the collection of such results and reporting to funders.

CCDB was enhanced to improve the national resource allocation process, enabling Compute Canada to improve the user experience by getting access to greater than the default amount of resources for the upcoming year. These enhancements also allowed more effective management of the resource allocation committee process to ensure allocation to the highest quality researchers.

Compute Canada also initiated a process to consolidate usernames across Canada in early 2013. This initiative will allow individuals to use the same username on every Compute Canada system to which he or she has access. Compute Canada will move towards a more streamlined process for granting access to Compute Canada systems.

C3. Please outline any training opportunities provided to students and post-doctoral fellows during the period extending from January 1 to December 31, 2012.

Compute Canada and the regional partners held a total of 133 training activities (see Appendix C for full listing) reaching more than 2,800 participants. The training activities included getting access and using Compute Canada resources, introduction to programming and general HPC information. Advanced topics in programming, utilizing specialized hardware resources and seminars about using specific tools were also held. Technical training seminars were delivered to a broad group of users. Some events were

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1 This does not indicate 2,800 unique individuals as some participants could attend one or more events. Unique individuals were not tracked and so those reports are not available.
Researchers who are using Compute Canada resources gave presentations at seminars across Canada to provide new and existing researchers ideas on how to use Compute Canada resources in their research. The longest running activity is the Coast-to-Coast seminar, which is held by videoconference and offered at more than 20 locations across Canada. This series highlights a different discipline annually and hosts researchers presenting specific topics at institutions across Canada. Last year a total of 7 coast-to-cost seminars were held drawing a total of 402 attendees.

C4. Please describe the activities undertaken by the MSI during the period extending from April 1, 2012 to March 31, 2013 to keep abreast of scientific and technical advances and support the development and training of its staff.

The most significant activity that staff participated in was the annual SuperComputing (SC) held in November of 2012 when Compute Canada sent a total of 31 staff to Salt Lake City, Utah to participate in this international event, the largest on the topic of HPC infrastructure. It draws more than 12,000 participants from academia, industry, non-profit and government organizations. This event allows staff to learn more about how international organizations are effectively supporting and operating similar HPC infrastructure. It also allows Compute Canada technical staff to participate in “whisper suite” talks in which major disclose the technical roadmap of upcoming technologies. This information is the basis for effective planning of future resource acquisition as well as providing advice and expertise to researchers who are acquiring their own HPC infrastructure as contributed infrastructure to the network. Given uncertainty in CFI funding for the MSI at the time of SC’12, each institution or region determined which individuals, if any, would attend the event based on the available funding at that site. Compute Canada covered the cost for the two staff people who were responsible for organizing the booth to ensure Compute Canada’s presence at the event ran smoothly.

In addition to the SC’12 Compute Canada also sent staff to a number of national and international events to gain expertise on operating technical resources effectively, training to support researchers and opportunities for expansion of the use of the resources by non-traditional disciplines. The complete listing of events Compute Canada participated in include:

- SC12, the International Conference for HPC, Networking, Storage and Analysis in Salt Lake city;
- ISC12, International Supercomputing, in Hamburg, Germany;
- HPCS 2012, Vancouver;
- Developments in Heterogeneous Computing Technologies, Toronto;
- Moab CON 2012, Park City, Utah;
- Canada 3.0 Digital Media Forum, Stratford;
- NVIDIA GPU Technology Conference, San Jose, California;
In addition Compute Canada held internal events to ensure the effective dissemination of information and sharing of best practices learned from attending external events. In addition to a face-to-face meeting and sharing of information at HPCS, Compute Canada holds bi-weekly TECC-SC meetings by videoconference. These meetings include the technical leaders from across Canada. National working groups have been created to continue the development of national initiatives and sharing of information. Three examples of such working groups include networking, access to resources, and the collaboration of working groups.

D. Risk Assessment

D1. Please describe the results of any risk assessments completed during the period extending from April 1, 2012 to March 31, 2013. If a risk assessment was completed over the past year, please describe any mitigation or monitoring strategies developed as a result to reduce the MSI risk profile.

During the period both the VP(R) Advisory Board and the inaugural Board did an assessment of the risks to the organization and chose appropriate mitigation.

From April to November 2012 the most significant risk to the organization was the uncertainty related to Compute Canada’s MSI funding as expressed in the response from CFI on March 26, 2012. Many activities during this period were influenced by this risk as Compute Canada ensured that the organization met the conditions outlined by CFI in the response letter.

Risk: Negative response from CFI regarding the request for funds through MSI program.
Impact: High.
Mitigation Strategies:

• Hired Interim Executive Director, Jill Kowalchuk, to lead the organization during the interim period until funding was confirmed and a CEO could be hired.
• Focused all efforts on meeting the necessary conditions specified by CFI.
• Communicated with the institutions and regional partners that the CC priorities were related to meeting these conditions.
• An Advisory Board Committee was active in the CEO recruiting activity in partnership with Western University (lead institution) until the independent was board was elected. Odgers Berndston was contracted to lead the effort.
• Executive Director and the Independent Chair of the Advisory Board led the creation of the Advisory Committee on Governance and Management.
• A consultant was hired to support the Executive Director in the creation of the Compute Canada report on the cost-benefit analysis. Identifying the key issues the Board would need to consider when looking at consolidating efforts.

Risk: Insufficient matching funding.
Impact: High.
Mitigation Strategies:
• The institutional lead for each province, where appropriate with the regional director, led the discussions with the provinces related to securing matching funds. This allowed the Compute Canada Executive Director to focus on securing the CFI funding while still finding the necessary matching funds.

Risk: Lapse in operation of the infrastructure from giving priority to meeting the CFI conditions.
Impact: High
Mitigation Strategies:
• Worked with the regions and institutional partners to have them lead continued operation of the resources with limited direction and leadership from Compute Canada.
• Focussed on maintaining operations with existing policies and processes to ensure continued effective operation of the network.

Risk: Inability to run the national office due to limited administrative support.
Impact: Medium.
Mitigation Strategies:
• Developed operating agreement between Western University (MSI Lead) and Cybera (not-for-profit corporation in Alberta) to enable the efficient and immediate secondment of the Interim Executive Director as well as providing administrative support of the organization on an interim basis.
• Hired additional administrative support for the organization through WordWrap Associates in Toronto and tasked the incoming CEO with developing the necessary administrative offices.

E. Research and technology transfer

E1. Please provide a brief summary of the main research activities of the MSI during the period extending from April 1, 2012 to March 31, 2013.

Compute Canada is a research-enabling platform, directly powering the research of its 1,451 user groups (including 3,261 HQP). However, the application of advanced computing resources to new research question often represents an applied research problem - if the computational tools to investigate a particular research question already existed or were
easily assembled, then competitors would likely have already addressed the question under consideration.

Creating new computational approaches for a particular research endeavour is an applied research problem requiring a combination of applied mathematics, computer science, and software engineering expertise, as well as expertise in the scientific or scholarly domain under consideration. Compute Canada’s staff, individually and in teams assembled for the purpose address these questions in collaboration with user researchers. Such applied research advances are often published in their own right (“A computational method for...”) or as part of the early research results generated by the new tool.

Since Compute Canada staff take on such applied research on behalf of - and typically in collaboration with - individual user groups, the desired end result is always some form of technology or IP transfer. To avoid duplication in this report this is categorized as technology/IP transfer activities, and listed under section E4, as efforts which resulted in an easily defined, complete, computational tool which was transferred to an individual user group or community. Those research activities which did not generate a tangible deliverable, or whose most visible deliverable was a published paper, are listed in this section under research activities.

This report provides representative efforts from across the country selected from the many dozens of such activities.

Some of Compute Canada’s representative research efforts include:

- Compute Ontario staff Scott Northrup worked with Drs. L. Ivan and H. De Sterk (Waterloo) and Hans De Sterck over the past year modifying a research code for use with magneto-hydrodynamics on a form of grid useful for considering spheres (e.g., planets). This work resulted in a novel way of adapting the resolution of such grids so that the computational effort is expended only where it is necessary. In addition, this new method allows more highly-accurate numerical methods, further reducing the computational cost of such approaches and increasing simulation fidelity. Finally, performance at large-scale (both computational and data handling) were significantly improved. The resulting publication was submitted to the prestigious J. Comp. Phys, where it will be published later this year as Lucian Ivan, Hans De Sterck, Scott A. Northrup, Clinton P.T. Groth Multi-dimensional finite-volume scheme for hyperbolic conservation laws on three-dimensional solution-adaptive cubed-sphere grids, 15 December 2013 Journal of Computational Physics, v. 255

- A WestGrid Compute Canada analyst worked with Psychology postdoctoral fellow Philippe Rast to move their data-analysis from a desktop to the WestGrid cluster, examining different approaches to do the new large-scale analyses. After this work, Dr Rast stated, “I waited for days to get an answer on my machine but now only a few hours on the nestor cluster, using hundred of cores”
E2. Please describe any new partnerships or key collaborations that the MSI has developed during the period extending from April 1, 2012 to March 31, 2013 with the aim of maintaining and enhancing its research capacity.

The partnerships outlined below were aim to enhance the capacity of Compute Canada to support researchers and the research community.

A significant partnership in the period was with Cybera and CANARIE on the Digital Accelerator for Innovation and Research (DAIR). Cybera and Compute Canada submitted a proposal to the program. As the successful proponents of the program, the only one selected, Compute Canada and Cybera deliver cloud resources for Canadian high-tech entrepreneurs. Compute Canada provided expertise to acquire and deploy the resources at the University of Alberta and the University of Sherbrooke. Compute Canada staff ensure the infrastructure is operational and that the software is effectively managed.

Compute Canada, through the regional node HPCVL, is partnering with the Ontario Brain Institute (OBI) to support the brain research database called BrainCODE. In this partnership HPCVL is hosting the infrastructure required to run the BrainCODE database. HPCVL is well positioned with extensive expertise in working with personal health information and meeting the special privacy and security issues related to hosting this type of data.

Compute Canada, through the regional node SHARCNET, partnered with Kitchener-Waterloo Hydro and the University of Waterloo to reduce the energy consumption of SHARCNET systems at the University of Waterloo while maintaining existing computational capabilities, a partnership was formed with Kitchener-Waterloo Hydro to leverage energy-efficiency incentives to decrease power usage. By replacing aging servers with new HP ProLiant servers, the SHARCNET consortium can now deliver up to 20x better performance per server while using 95 percent fewer servers to achieve the same overall cluster performance.

E3. Please outline any other opportunities pursued by the MSI to maintain or enhance its research capacity.

Since it is Compute Canada technical staff who pursue the applied research efforts of the MSI, a key part of maintaining and enhancing its research capability is the continued professional development of its technical staff. The staff took part in many professional development and training activities as included in section C4, e.g. the annual international supercomputing conference and the High Performance Computing Symposium, put on by the Canadian community led by Compute Canada. Such events have a particular focus on training and are particularly important in maintaining and enhancing research capacity.

In addition, Compute Canada began exploring opportunities for supporting medical science researchers who work with personal health information. Managing Personal Health Information (PHI) is a complex legal and technical matter that was only partially addressed by Compute Canada in previous years through HPCVL in Kingston. Making further progress
to support researchers using and storing PHI will be a major activity for Compute Canada in the future. In early 2013, Compute Canada started exploring opportunities to expand the capabilities of the network to support researchers with sets of data with unique privacy and security concerns. It is expected that additional partnerships will be formed in the coming year.

E4. Where applicable, please describe any IP or technology transfer with significant contribution from the MSI during the period extending from April 1, 2012 to March 31, 2013.

Below are some representative IP and technology transfer activities, as defined in section E1, for the reporting period.

- The genomic research community uses many commercial software packages that cannot be modified but performance limitations in some of these software packages often limit the size of problems which can be feasibly studied. Typically the performance of data reading and writing (input and output, or I/O) is limited. A Compute Canada team from Calcul Québec developed a tool called IOBUFF, which intercepts system calls related to I/O operations on files. In small test cases, performance can be ten times faster, greatly increasing what research can be performed. This tool can be used also outside of the genomic community. In the Astrophysics code Phoenix, that computes stellar atmospheres and uses large data sets for atomic and ionic opacities, the measured speed increase was a factor of nine, again without change to the software itself.

- A Compute Canada analyst from Calcul Québec helped a group in astrophysics analyzing telescope data to search for gravitational lenses and other exotic objects. They needed to read files in an obscure format before performing spectral analysis. The researchers’ software required more than 48 hours to process a single image, and they were limited to using a single compute node at a time, further limiting the size of the image that could be processed. Thus they would not have enough memory or time on a single node to perform the required analysis. The CC analyst rewrote the software to read the data more efficiently and to use multiple nodes. The astrophysicists analysis now runs in about 15 minutes on about 10 nodes, and they are able to analyze many more data files than they initially thought possible.

- A Compute Ontario analyst continued his work on a metaprogramming environment, “HWT 7.1”, which speeds the development of massively parallel scientific computation tasks by enabling such features as differential debugging (examining the output from very large scale calculations by noting the differences between two versions of a given piece of software).

- A WestGrid Analyst worked with University of Victoria Forest Biology Master’s Student Amber Paulson to develop software to enable a very large number of bioinformatics analyses and identify interesting viral organism in megastigmus
sequences. Ms. Paulson reported: “Depending on the bio-informatic tool I used, the speed can be increased from 5 times faster to incomparably faster than on the desktop”.

Many CC technology transfer projects result in new versions of software which are enormously more powerful, significantly increasing their ability to perform cutting-edge research. These projects typically require both deep understanding of the performance of high-end computing equipment, best practices in modern software development, and research into applied mathematical techniques for improving or replacing algorithms for certain computational tasks. Some examples of this are Compute Canada staff working at Compute Ontario developing and transferring new versions of software that improved the performance of Wilfred Laurier CS professor Dr. Kotsireas’ research software by almost a factor of seven; Carleton electrical engineering professor Dr. Banihashemi’s research software by a factor of 20; Laurentian Physics professor Dr. Virtue’s research software by a factor of 650; and Guelph History professor Dr. Inwood’s data analysis software by a factor of 1000. Changes of this magnitude can completely alter what sort of research is possible to perform.

F. Benefits to Canada

F1. Please outline achievements that have led to benefits to society, health, the economy and the environment through the development of new or improved products, processes, services, public policies, and/or sustainable job creation during the period extending from April 1, 2012 to March 31, 2013.

Compute Canada responds to the needs of the research community by delivering the tools and resources to enable Canadian researchers.

For example, at the Université de Sherbrooke, Associate Professor Elijah Van Houten is using Compute Canada resources to support his group’s work in the field of elastography, the imaging of elastic properties in soft tissue. One focus is the elastographic method known as Digital Image Elasto-Tomography (DIET), which is primarily targeted at breast cancer screening, but also has potential applications in detection and diagnosis of musculoskeletal injury and lower back pain. High performance computing is used to reconstruct the elastic property images from the measured data, essentially a large-scale "inverse problem". In 2012, Van Houten used Compute Canada to complete the first clinical trial of the DIET process, successfully detecting and localizing all cancers presented. These highly effective, non-invasive imaging techniques have the potential to revise the treatment of medical conditions that affect thousands of Canadians every year, with significant social and economic impact. Van Houten’s research would not be possible without access to Compute Canada infrastructure due to the highly complex, non-linear methods in his elastographic techniques.

At McGill University, access to powerful computing resources is critical for Hong Guo’s research as he works to establish a new technological computer aided design (TCAD) tool for nanoelectronic device design and materials design. Guo is using computationally intensive modeling tools to investigate important and interesting problems in device
physics, materials physics, and the novel technology of nitride-based artificial photosynthesis. This kind of research has a number of industrial and commercial applications. For example, in 2012, Guo and his colleagues obtained two NSERC SPC grants for developing nanowire artificial photosynthesis and laser technology in collaboration with Hydro-Quebec and Alcoa Canada, a leading producer of primary and fabricated aluminum. In addition to the development of new products, Guo’s research also creates sustainable jobs. In addition to his role as a James McGill Professor, Guo is also the President and CEO of NanoAcademic Technologies, a company he founded in Brossard, QC with fellow McGill researchers. NanoAcademic Technologies currently provides employment for six highly qualified personnel and develops state-of-the-art modeling software for industrial, government and academic clients.

Compute Canada resources are also being used to help researchers better understand our environment and manage our ecosystems. For example, Associate Professor Robin Gras at the University of Windsor is using Compute Canada resources to operate EcoSim, a predator-prey evolving ecosystem simulation, unique in that it is the only simulation that models the fact that individual behaviors affect evolution and speciation. The computational demands of this simulation are impressive. In one run of the EcoSim simulation, more than 1 billion agents can be born and several thousands of species can emerge and become extinct. Compute Canada infrastructure is used to run the simulation, store and analyze the data generated. Last year, Gras discovered sets of rules that characterize situations in which a species will become extinct, a new species will emerge, or a variation in species richness will increase in an ecosystem. In addition to academic publication, this work received widespread media coverage in publications such as ACM TechNews, USA Today, the Windsor Star, Metro, Computer Power User, and C-Fax 1070 Radio. Gras’ findings have contributed new insights on the effect of human behaviour on ecosystems as well as improved our ability to predict and manage possible species extinction, the probability of a species invasion, and the diffusion of diseases in populations.

Canada’s judiciary system is benefiting from a Compute Canada user’s research at Simon Fraser University. Anoop Sarkar, an Associate Professor in the School of Computing Science, used Compute Canada resources last year to customize a solution for translating Canadian court judgments between English and French. Sarkar’s research group at the Natural Language Lab explores statistical machine translation (SMT) with a particular interest in morphologically complex languages and multi-domain and multi-lingual translation settings. Supported by Compute Canada resources, Sarkar trains his machine translation models using massive amounts of bilingual data, resulting in hundreds of millions of parameters in the models. Next, a decoding process uses the trained models to translate the source language text into the target language. Sarkar’s research lab concentrates its efforts in specialized and high-impact domains, such as the judiciary and medical sectors, and works on different language pairs of strategic interest to Canada including Chinese and Arabic with particular emphasis on bridging the need for translation between English and French.
These are a just a few examples of achievements by researchers using Compute Canada resources during the period of April 1, 2012 to March 31, 2013 that led to benefits in the health sector, economy, environment and society.
2. Upcoming year activities for the period extending from April 1, 2013 to March 31, 2014.

A. Governance and strategy

A1. Please list and describe the specific objectives and targets for the period extending from April 1, 2013 to March 31, 2014. Please indicate how these objectives are anticipated to contribute to achieving the MSIs strategic goals.

Objective #1: Development of a rolling five-year strategic and operating plans and budgets – to guide the effective and efficient use of resources in the achievement of the CC mandate

Objective #2: Development of cost-benefit analysis of Compute Canada infrastructure and resources - as the basis for a process and plan to achieve an optimal set of CC data centres

Objective #3: Complete a comprehensive assessment to determine and understand the needs of researchers and the research community – to enable an effective response to future calls for infrastructure needs.

Objective #4: Create an advisory council - to provide advice and guidance on the current and predicted directions of scientific research

Objective #5: Development of relationships with major hospitals - to expand CC’s reach into the medical sciences and genomics communities.

Objective #6: Open initial discussions with the humanities and social science disciplines – to develop understanding of the needs for research in these fields

Objective #7: Explore possible synergies with major partners – to achieve greater effectiveness in the deployment of resources.

Objective #8: Hiring full time resources for the CEO, CTO, CSO and financial management positions – to achieve fully operational status under the direction of a senior leadership team

Objective #9: Undertaking the first external audit – to ensure the appropriate use of financial resources and provide the basis for disclosure.

Objective #10: Define and document the relationship between Compute Canada, the regional and institutional partners.
B. Management

B1. If applicable, please describe any major actions that will be taken to enhance or improve the management of the MSI for the period extending from April 1, 2013 to March 31, 2014. These actions may include a review of plans, priorities and procedures or the adoption of best practices.

- Further development of internal financial control and reporting processes to achieve transparency and financial control standards comparable to a public company.
- Development of a set of policies and procedures.
- Development of internal systems to handle human resources and office administration.
- Hiring of administrative and bookkeeping support.
- Determine the most effective office facilities.
- Document and publish the process for managing the removal of awards with conditions related to Compute Canada.
- Define and document the relationship between Compute Canada, the regional and institutional partners.

C. Users access and training of HQP

C1. Please outline the activities that will be undertaken by the MSI for the period extending from April 1, 2013 to March 31, 2014 to increase the awareness of the potential user communities of the activities and opportunities offered by the MSI.

As part of the Strategic Plan, Compute Canada is developing a comprehensive Outreach, Education and Training plan. This plan will provide details on the objectives for the organization related to increasing the awareness of potential user communities. To support this activity, the organization is also developing the services catalogue. This will define the existing services provided by the organization as well as start to outline the future services that will be provided. This services definition will help to guide Compute Canada and partner organizations when discussing what the organization can provide to potential users and user communities.

Compute Canada will develop partnerships with key research hospitals provide an opportunity to increase awareness in the genomics and medical sciences communities.

Compute Canada will develop a relationship with Genome Canada. Through this partnership, we will extend the research communities, which might benefit from our services and expertise.
C2. If applicable, please describe any changes that will be made for the period extending from April 1, 2013 to March 31, 2014 to the MSI’s current mechanism for user access and/or to the current user fee policy towards the various types of users (e.g., internal or external, academic or non-academic).

Compute Canada will continue to refine the system and mechanism for getting access the infrastructure with particular attention to achieving single sign-on capability and efficiencies related to the account renewal system.

C3. Please outline any new training opportunities that will be provided to students and post-doctoral fellows for the period extending from April 1, 2013 to March 31, 2014.

The Outreach, Education and Training plan will outline additional tools and training opportunities for students and post-doctoral fellows. In 2013-14 we will continue to run our existing training courses. However, as the plan is developed we hope to start bringing on new opportunities for courses and training materials.

Two specific activities that are being investigated as part of the Outreach, Education and Training plan that would be provided to students and post-docs include:

- Scholars Program: opportunity for students to attend the annual HPCS conference. Providing them with exposure and training to formal training related to the use of advanced computing systems.
- International HPC Summer school: A collaboration with XSEDE (US) and PRACE (Europe) in which students would apply and be selected to attend the week long face-to-face training event led by international experts to be held in Europe in Summer 2014.

These activities are modeled after successful programs run by XSEDE, the equivalent organization to Compute Canada in the US.

C4. Please describe the activities that will be undertaken by the MSI for the period extending from April 1, 2013 to March 31, 2014 to keep abreast of scientific and technical advances and support the development and training of its staff.

In 2013-14 we will be developing a high level plan which will guide the training and professional development of our staff. In this period we will continue to send staff to the key training events for HPC, which includes ISC in Germany, and Supercomputing to be held in Denver in November 2014.

The plan being developed will provide guidelines for regions and institutions to ensure that we are maximizing the learning for our staff in a variety of opportunities. In the plan, we are looking at opportunities for our staff to develop extended expertise into specific research areas, by potentially sending staff to discipline specific events. This would not only provide staff with the opportunity to develop their expertise in a given discipline, but it would also provide the opportunity to promote the services that we could provide to that research community.
We will also hold our annual HPCS event to ensure the effective dissemination of best practices in Canada. This year we will hold birds of a feather sessions to enable staff to bring forward ideas and opportunities for potential collaborations. In 2013-14 we will also hold a technical staff form. This event will bring together a significant portion of the technical staff to share and collaborate with a focus on technical items. This event will help develop the technical road map and plan that will guide future technical plans.

D. Risk Assessment

D1. If applicable, please describe any risk assessment activities that will be undertaken during the period extending from April 1, 2013 to March 31, 2014.

The Compute Canada Board and Senior Management team are assessing the risks to the organization on an ongoing basis. In the coming period the focus is developing the strategic plan and a comprehensive risk assessment will be a part of that process to be completed during this period. Until this can be completed, CC will continue to assess, evaluate and mitigate risks to the organization using informal methods.

The most substantial risk to the organization in the coming year, similar to the last year, is the risk of not securing the necessary funds to operate the platform. The strategic plan will include strategies to mitigate this risk. The most immediate risk associated with funding is securing the necessary matching funds for the period April 1, 2014 - March 31, 2015.

A strategic priority for the organization is the development of the Senior Management Team. In particular, adding a Chief Technology and Science Officer to support the President. This is important to risk assessment in two ways. First, the lack of resources to fulfill the responsibilities of the National Office is a significant risk for the organization in the coming period. Second, the expansion of the Senior Management Team will allow the organization to more effectively identify and mitigate the risks associated with the organization.

E. Research and technology transfer

E1. Please provide a brief summary of the planned main research activities of the MSI for the period extending from April 1, 2013 to March 31, 2014.

Compute Canada’s primary objective is to promote and support the shared use of advanced computing to enable research and innovation for the socio-economic benefit of Canada. Any research activity relates to the support of researchers using the infrastructure, which often results in applied research advances.

Our support team collaborates with researchers from all disciplines tackling requiring a computing network. Compute Canada gives special attention to the researchers requesting and being granted significant computational awards through its annual Resource Allocation Committee (RAC) process. In particular, it ensures that the researchers with large awards are making efficient use of the resources. Researchers who could benefit from one-on-one
support in optimizing their codes are indentified through the RAC process and follow up is
given to develop the most effective computational solutions.

In 2013-14 Compute Canada will seek to improve the methods for tracking and identifying
research support for users. This will allow a more effective knowledge transfer throughout
its network of technical expertise. Although knowledge transfer takes place between staff,
it has traditionally been done through informal communications. It is important that this
informal transfer of knowledge does not stop, but is complemented with a formal
communication structure.

A significant research activity for 2013-14 will investigate the needs of the broad research
community. This will be done through a number of activities; the largest of which will be a
user needs survey. This will be followed up with selected researchers to gather additional
information on a one-on-one basis. This research will lead to a roadmap of the resources
required by the community when the network is refreshed. This roadmap will support CFI
and other funders in the development of future infrastructure calls and prepare Compute
Canada to respond effectively to such requests for proposals.

E2. Please outline the main opportunities that will be pursued by the MSI for the period
extending from April 1, 2013 to March 31, 2014 to maintain or enhance its research
capacity, including the establishment of new partnerships and collaborations.

In the coming year, Compute Canada will expand its ability to research and develop
effective solutions to problems in the medical science and genomics disciplines. The
partnerships being developed with the genomics centre in Vancouver and the hospitals in
Toronto will extend the network of expertise in Compute Canada and allow for additional
knowledge transfer.

In addition, Compute Canada extends its research and technology transfer capabilities in
data storage and archiving. These areas are growing at an exponential rate, and the need to
develop effective solutions to meet the challenges of data storage and curation is critical.
This work will extend well beyond Fiscal 2014.

E3. Where applicable, please describe any opportunities the MSI will pursue to promote the
use of MSI-developed IP / technology for the period extending from April 1, 2013 to
March 31, 2014.

In 2013-14 Compute Canada plans will continue to promote the use of the MSI-developed
IP/technology through seminars, website desimination and one-on-one support. As noted
in Question E1, formal methods for tracking the IP will be developed in the period, creating
a plan related to the education, outreach and training and specifically addressing
technology transfer.
A secondary benefit to the User Needs Survey that is planned for 2013-14 will be the identification of users who could benefit from the research solutions developed by the CC support team.

F. Benefits to Canada

F1. Please outline any anticipated achievements that will lead to benefits to society, health, the economy and the environment through the development of new or improved products, processes, services, public policies, and/or sustainable job creation for the period extending from April 1, 2013 to March 31, 2014.

Compute Canada’s extensive network of computing resources, data storage facilities, research tools and technical expertise supports projects that will feed into a thriving Canadian R&D sector and contribute important socio-economic benefits to Canada.

For example, in July 2013, following millions of hours of data processing time on Compute Canada advanced computing facilities, McGill Professor Alan Evans and his fellow colleagues on the international Big Brain project announced they had completed the world’s first high-resolution 3D digital model of the human brain. The whole-brain model is 50 times the resolution, in each of the three spatial dimensions, of previous models, revealing microstructural brain organization at an unprecedented level of detail. The model was created by slicing a 65-year-old human female’s donated brain into hair-thin sections, scanning them, and then using corrective software and intensive data processing to refine and correct each digital scan to produce the highest resolution 3D model of the brain to date. It took thousands of hours to assemble more than 7,400 images of individual histological sections, each with its own distortions, rips and tears, into a coherent 3D volume. In one year alone, Compute Canada supported the project with more than 6.2 million compute hours. The Big Brain researchers say they plan to extract measurements of cortical thickness to gain insights into understanding aging and neurodegenerative disorders; create cortical thickness maps to compare data from in vivo imaging; integrate gene expression data from the Allen Brain Institute; and, eventually, to generate a brain model with a spatial resolution of 1 micron to capture details of single cell morphology.

Other researchers are using Compute Canada infrastructure to make breakthroughs in clean technologies that will have significant impacts on the environment. Research has shown that coal combustion to generate electricity accounts for nearly 40% of the world’s carbon dioxide (CO2) emissions. At the University of Ottawa, Professor Tom Woo is using Compute Canada to develop new advanced materials for capturing CO2 from burning fossil fuels in order to mitigate the greenhouse gas emissions from these energy sources. Woo’s lab has developed algorithms to virtually construct hypothetical materials and to simulate the CO2 capture process in these materials at the atomic level. These simulations are used to screen and identify promising materials that can make post-combustion CO2 capture a practical reality. To date, Compute Canada resources have been used to screen hundreds of thousands of candidate materials, resulting in several promising materials being identified that are now being synthesized in the labs of collaborators. Woo’s use of Compute Canada resources has also enabled a partnership with Inventys of Vancouver, who is currently
building a post-combustion CO2 capture pilot plant at Nova Chemical Corp.’s petrochemical plant in Joffre, AB. Compute Canada resources will be used to virtually screen new materials that will be specifically tailored to Inventys’ VeloxoTherm technology process, to optimize its energy efficiency, thereby making it an even more cost-effective means of capturing CO2. Inventys’ CO2 capture plant installation is expected to be complete in early 2014.

At Laval University, Professor Guy Dumas’ research at the Laboratoire de Mécanique des Fluides Numérique (LMFN) is focused on the hydrodynamic analysis and optimization of different types of turbines for green, renewable energy production. New concepts are proposed and tested, and existing ones are improved through extensive parametric studies using state-of-the-art computational fluid dynamics techniques to simulate the complex, unsteady turbulent flows involved. Compute Canada infrastructure is used to run large 3D simulations of different configurations and various operating conditions over many cycles of the turbine in order to get reliable data on its energy extraction efficiency. Access to Compute Canada resources has enabled Dumas’ research group to refine their simulations and expand their product’s application into emerging sectors such as tidal energy and in-stream hydrokinetic energy. Last year, Dumas used Compute Canada facilities to develop a second-generation concept of a more robust and scalable oscillating-wings turbine (HAO). This is scheduled to be prototype-tested by the end of 2013. Research such as this pairs environmental benefit with innovative commercialization opportunities and sustainable job creation through new market and product developments.

These are just a few examples of the research projects using Compute Canada resources that will lead to benefits in the health sector, environment, society and economy during the period of April 1, 2013 to March 31, 2014.

3. Provide an update on the strategic plan, management plan and decommissioning plan (only if changes were made in the past year and if it has not already been addressed in the above sections)

This question has been addressed by previous answers. Given that strategic and to a large extent operating plans are major activities in Fiscal 2013/14, more specific answers will not be feasible until the next report.
Part 2 – Financial report

1. Please complete the financial report templates provided. Any departure from the budget items that were presented in the updated operations and maintenance budget must be explained.

The first money was released for the period April 1, 2012 to September 30, 2013. CC is currently developing the updated budgets for the subsequent 18 month period, October 1, 2013 to March 31, 2015. The attached financial award shows the actual expenses for the period April 1, 2012 to March 31, 2013 and the forecast for the subsequent year. Given the unique 18 month situation for the flow of the first money from CFI, the second year budget in the attached financials is based on an updated budget for April 1, 2013 to September 30, 2013 multiplied by two to represent the entire year. Compute Canada expects to have its updated 18 month budget for the period October 1, 2013 to March 31, 2015 completed and approved in the next 60 days.

Compute Canada is below budget by just under $1 million for the period April 2, 2012 to March 31, 2013, representing a variance of less than 4%. The most significant variances are attributed to the maintenance and warranty and services categories.

The maintenance and warranty category has a variance of $600K from the budget, mostly due to a decision related to a warranty. A large system located at the University of Toronto and purchased during the national platforms fund came off warranty in this period. This system is critical to the researchers supported by Compute Canada and as such the extended warranty was budgeted to keep it operational. An assessment found that the cost of replacing the parts expected to fail would be lower than extending the warranty. This will result in a higher cost budgeted to replacement parts in the future, but an overall cost reduction.

The second largest variance from budget is 200K on the services category which mostly relates to the cost of utilities. The most substantial amount is the result of a formula error on the original budgets related to an over estimation of $150K at the University of Calgary.

Compute Canada budgeted 137.8 staff and is reporting 137 staff. The slight variance is due to hires not being in place when expected during the period.

In 2012-13 there were some significant differences on a few items by region. Compute Canada did not have confirmed funding from the MSI program until late in 2012 and as a result institutions and/or regions were required to front the cost of operations. As such, given limited funds and differences related to existing grants, institutions made varying decisions on risk and how to spend the limited funds. In the coming year, spending will be rationalized on a national level and will be more consistent by region when based on the size of the region in terms of users.

The most significant differences by region are the larger spending on both maintenance and services in Ontario. Both of these variances were expected given the larger amount of
infrastructure that is deployed in Ontario, a larger portion of which is coming off of warranty but still deemed useful, resulting in a larger cost to keep these systems operational. Services are higher not only due to the larger amount of infrastructure deployed but the higher cost of electricity in the province.

Outreach expenditures for the period also varied by region. In particular, Calculq Quebec ran a large, two-week international summer school in HPC. The school had been planned in advance and science departments, the University of Sherbrooke and the province of Québec contributed the funds for the event. Compute Canada is reviewing the results of this event to determine the most appropriate deployment of resources for training and outreach in the coming years. Each year, one region is selected to host HPCS. This year it was run in Vancouver hosted by WestGrid. As such, the outreach cost for this region is higher.

The matching funding in the province of Ontario was confirmed, but the funds were not released in 2012-14. As a result, the University of Toronto and Queens University provided a “loan” as a match until the funds flow from the province. This loan ensures that overall CC is not exceeding the 40% contribution from CFI in year 1. Similarly, funding was loaned from Memorial University of Newfoundland in Atlantic Canada to cover delayed matching funds flowing to the appropriate institutions in Atlantic Canada. In year 2, those institutions will be repaid when the money flows from the provinces.

2. Please discuss the strategy to secure the operations and maintenance budget for the upcoming year. This should include all anticipated and committed revenues from other sources: user fees, if applicable, and contributions from universities and other organizations.

In 2012-13 matching revenues were contributed by 24 institutions, 8 provinces (2 from the province of Quebec), 11 vendors (through the annual HPCS conference), 10 non-profit contributors and NSERC. Compute Canada has secured all the matching funding for fiscal 2013-14. The sources of funding will be similar to that in the previous year.

Beyond March 31, 2014 some matching contributions have yet to be secured. Compute Canada is currently developing the details on the 18-month budget for the period October 1, 2013 to March 31, 2015 and the exact details on short-falls in contributions will be known at that time. A summary of matching contributions for the 2014-15 (Fiscal 2015) by region is as follows:

Atlantic Canada – all institutional and provincial matching sources confirmed.

Quebec – Matching funding for Fiscal 2015 is not yet secured. The request is with the province awaiting a formal response. There is no indication on the timing of notification about the request.

Ontario – Matching funding for Fiscal 2015 is not yet formally confirmed. However, the province is committed to the advanced computing agenda. Advanced computing is seen as a competitive advantage for the province of Ontario and CC has received positive signals
from the province that a significant portion of the matching funds for Fiscal 2015 will be available.

West – Matching funds for Manitoba, Saskatchewan and Alberta have been secured through Fiscal 2015. Matching funds from the province of British Columbia (BC) to support the operations and maintenance of the project have yet to be confirmed.

3. Please describe plans for the use of the CFI and MRS funds for the next fiscal year (April 1, 2013 to March 31, 2014).

Compute Canada will use CFI and matching funds to continue operations of the network in 2013-14. Compute Canada's expenditures are forecasted to increase by 18% ($4.6 million) in year 2. The increase in expenditures is due to a number of factors:

- Expenditures in year 1 were delayed due to uncertainty in funding from the MSI program. Confirmation of funding from CFI and most of the provincial partners was not confirmed until late in year 1 or in some cases not until year 2.
- Compute Canada is currently developing working relationships with key life sciences organizations and this will add nodes to the Compute Canada network. The expanded scope in services will increase expenses significantly (estimated at $2 million).
- Compute Canada's major infrastructure purchases from the national platforms fund are starting to become out of warranty. These systems are still critical and as a result a large budget must be allocated to maintenance and repairs to keep these systems operational. Although a significant amount has been budgeted on this line all purchases will be considered as part of the Operational and Maintenance plan (see key changes below).
- The other significant budget increase relates to the general administration category. This increase is attributed to delayed expenditures as noted above, but also due in large part to a delay in setting up the national office. Compute Canada is also in the process of developing the outreach, education and training plan. The majority of the costs associated with supporting these critical activities are budgeted in the general admin category.

Some key changes for the 2013-14 budget starting October 1, 2013 will include:

- All spending on maintenance and repairs items will need considered as part of the ongoing Operational and Maintenance plan (which includes the targets for decommissioning each system). The operational and maintenance plan will outline the useful life of all systems. Purchases on this line item will be done based on a budget; the CEO must approve significant purchases within a Board approved budget.
- Similar to maintenance and repairs, services (ie: utilities) can only be put onto the budget for systems that are deemed to be “useful” as per the ongoing Operational and Maintenance plan.
• Spending for general and admin items will be done based on budgets, which contain principals to guide items such as admin supplies, travel & professional development for staff.

• Outreach spending will be done based on the strategic plan for Outreach, Education and Training. However, it will be important that flexibility be built into the budget for local and regional activities that are not planned, but will provide significant benefit to the national platform.

As with the year 1 budget, the majority of expenses will cover personnel and utilities.
Appendix A: Scientific Contributions

Books:

Pan, Yuanming. First-principles calculations of the E'1 center in quartz: Structural models, 29Si hyperfine parameters and association with Al impurity (2012).


van Breemen, Cornelis. Store-operated Calcium Entry (SOCE) Pathways (2012).

Book Content:

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Li, Ming. How Accurately Can We Model Protein Structures with Dihedral Angles? (2012).


Li, Ming. LoopWeaver – Loop Modeling by the Weighted Scaling of Verified Proteins (2012).


Rouat, Jean. Regulation toward Self-organized Criticality in a Recurrent
Spiking Neural Reservoir (2012).


Journals:


Zhorov, Boris. 1,4-Dihydropyridine Scaffold in Medicinal Chemistry, The Story So Far And Perspectives (Part 2): Action in Other Targets and Antitargets (2012).


Warkentin, Andrew. 3D metal removal simulation to determine uncut chip thickness, contact length, and surface finish in grinding (2012).


Bentourkia, M'hamed. A comparison of a Monte Carlo-based detection probability matrix with analytical probability matrix for small animal PET scanners (2012).


Gu, Jeff. A compressive sensing framework for seismic source parameter
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van Beek, Peter. A computational study of heuristic and exact techniques for superblock instruction scheduling (2012).


Horbatsch, Marko. A correction to Birks' Law in liquid argon ionization chamber simulations for highly ionizing particles (2012).


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Eliasmith, Chris. A Large-Scale Model of the Functioning Brain (2012).

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Tafirout, Reda. A measurement of the ratio of the W and Z cross sections with exactly one associated jet in pp collisions at with ATLAS (2012).

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Gauld, James. A Molecular Dynamics (MD) and Quantum Mechanics/Molecular Mechanics (QM/MM) Study on Ornithine Cyclodeaminase (OCD): A Tale of Two Iminiums (2012).

Karttunen, Mikko. A molecular dynamics implementation of the 3D Mercedes-Benz water model (2012).

Hoyt, Jeffrey. A molecular dynamics simulation study of the velocities, mobility and activation energy of an austenite–ferrite interface in pure Fe (2012).


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Noghanian, Sima. A Novel Microwave Tomography System Based on the Scattering Probe Technique (2012).


Dworkin, Seth. A numerical study of high pressure, laminar, sooting, ethane–air coflow diffusion flames (2012).


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Hallam, Steven. A programmable droplet-based microfluidic device applied to multiparameter analysis of single microbes and microbial communities (2012).

Simmonds, Rob. A protocol for quantifying the carbon reductions achieved through the provision of low or zero carbon ICT services (2012).

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APPENDIX B: TECHNICAL CONTRIBUTIONS

SOFTWARE OUTCOMES

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| Bielawski  | 1. BiomeNet (A Bayesian model for measuring metabolic divergence among microbiomes)  
               2. BioMico (A Bayesian model for estimating differences in the community structure of microbiomes) |
| Chen       | 1. Boreal Ecosystem Productivity Simulator (BEPS)  
               2. Integrated Terrestrial Ecosystem Carbon Model (InTEC) |
| Abukhdeir  | 1) FCGram software package, solver based upon spectral methods for solving partial differential equations in heterogenous computing environments. |
| Ilie       | 10.1016/j.jiec.2012.07.011 |
| Bengio     | 2: Theano: http://deeplearning.net/software/theano/Pylearn2:  
               http://deeplearning.net/software/pylearn2/ |
| Sykes      | A 3D Computer Assisted Treatment Planning System for Breast Cancer |
| Mehravaran | A Cartesian mesh, adaptive, fully compressible, and parallel Navier-Stokes solver with extremely high efficiency has been developed last year. |
| Wolf       | a computer algebra package sqlinsolve. red for solving extremely large sparse linear systems symbolically |
| Qureshi    | A distributed virtual vision simulator (http://faculty.uoit.ca/qureshi/projects/vvs/index.html) |
| Dibike     | A Hydrological modeling System for the Athabasca Watershed |
| Sorkin     | A large suite of new lisp programs (functions and macros) for working with partial orders, the physics applications being causal sets (quantum gravity) and anhomomorphic coevents (quantum foundations) |
| Menzinger  | A neural network model of Epilepsy is being analyzed. |
| Carrington | A new program for computing rovibrational spectra |
| Wagner     | A note about work accomplished with the help of WestGrid  
               http://www.mpich.org/2013/01/15/over-100-million-processes-with-mpich/ and also an article in HPC-Wire  
               WestGrid News Write-up  
               A Signpost on the Road to Exascale: UBC Researchers Use WestGrid to Explore Exascale Computing  
               https://www.westgrid.ca/westgrid_news/2013-01-14/ubc_researchers_use_westgrid_explore_exascale_computing |
<p>| Wu         | A program for dynamic analysis of legged walking robots have been developed and used for our group's research. We plan to make it a stand-alone software for research use. |
| Ashgriz    | A software that can simulate atomization of a liquid jet in cross flow using large eddy simulation is developed. |
| Côté       | ABINIT |
| Zwanziger  | ABINIT: I am one of the current developers of the ABINIT code, a Gnu GPL-licensed package for computing properties of materials from first principles. See <a href="http://www.abinit.org">www.abinit.org</a> for |</p>
<table>
<thead>
<tr>
<th>Greenwood</th>
<th>adaptive mesh algorithms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doxey</td>
<td>AFPredict, cbsPredict, COMPLEX</td>
</tr>
<tr>
<td>McGuigan</td>
<td>AJAX Web Scraper. A java tool to scrape the contents of AJAX-generated web pages: <a href="http://vancouverdata.blogspot.ca/2012/02/less-painful-ajax-javascript-web.html">http://vancouverdata.blogspot.ca/2012/02/less-painful-ajax-javascript-web.html</a></td>
</tr>
<tr>
<td>Beaulieu</td>
<td>ALGEBRA dose calculation platform (using the Geant4 toolkit)</td>
</tr>
<tr>
<td>Melko</td>
<td>All software can be seen on <a href="https://github.com/rgmelko">https://github.com/rgmelko</a> - 1D numerical linked-cluster expansion - Graph generation on a 2D square lattice - Spin models on GPUs - C++ implementation of DMRG algorithm</td>
</tr>
<tr>
<td>Moghadas</td>
<td>An agent based model of influenza spread within a remote northern Canadian community</td>
</tr>
<tr>
<td>van Beek</td>
<td>An implementation of the constraint programming approach to superbloc block instruction scheduling for realistic multiple-issue processors; an implementation of the algorithm for bounds consistency propagation of the alldifferent and gcc constraints.</td>
</tr>
<tr>
<td>Stroman</td>
<td>Analysis software for functional MRI of the spinal cord</td>
</tr>
<tr>
<td>Ward</td>
<td>Analysis software for wave parameter determination in all sky airglow images. Analysis software of data from a Martian general circulation model. Analysis software for a wind measuring satellite.</td>
</tr>
<tr>
<td>Diallo</td>
<td>Armadillo 1.0, Ancestors 1.1,</td>
</tr>
<tr>
<td>Eagleson</td>
<td>Augmented reality simulator</td>
</tr>
<tr>
<td>Arbel</td>
<td>Automatic head pose estimation from real-world video sequences is of great interest to the computer vision community since pose provides prior knowledge for tasks, such as face detection and classification. However, developing pose estimation algorithms requires large, labeled real-world video databases on which computer vision systems can be trained and tested. Manual labeling of each frame is tedious, time consuming, and often difficult due to the high uncertainty in head pose angle estimate, particularly in unconstrained environments that include arbitrary facial expression, occlusion, illumination etc. To overcome these difficulties, a semi-automatic framework was developed for labeling temporal head pose in real-world video sequences. The proposed multi-stage labeling framework first detects a subset of frames with distinct head poses over a video sequence, which is then manually labeled by the expert to obtain the ground truth for those frames. The proposed framework provides a continuous head pose label and corresponding confidence value over the pose angles. Next, the interpolation scheme over a video sequence estimates i) labels for the frames without manual labels and ii) corresponding confidence values for interpolated labels. This confidence value permits an automatic head pose estimation framework to determine the subset of frames to be used for further processing, depending on the labeling accuracy required. The experiments performed on an in-house, labeled, large, real-world face video database (which will be made publicly available) show that the proposed framework achieves 96.98 % labeling accuracy when manual labeling is only performed on 30 % of the video frames.</td>
</tr>
<tr>
<td>Rubel</td>
<td>BerryPi</td>
</tr>
<tr>
<td>Lina</td>
<td>BEsT (Brain Entropy in space and Time)</td>
</tr>
<tr>
<td>Giroux</td>
<td>bh_tomo; pve_vti_pml; pve_iso_pml</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
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<tr>
<td>Baillet</td>
<td>Brainstorm (neuroimage. usc.edu/brainstorm) is an academic software application for advanced MEG and EEG data analysis and functional imaging. My group has contributed methods and thousands of lines of code to this project, which I initiated with collaborators at the University of Southern California and at the Cleveland Clinic in 1999. Since then, the software has grown tremendously in sophistication and popularity: a full-time software engineer has been hired in 2007 to work on the project and more than 7,100 downloads have been registered since 2000. More than 150 scientific articles have been contributed from users and developers. Recently, I have organized training sessions in Canada (McGill, UQAM), France (SupTelecom) and the USA (MIT), which gathered 400+ attendees from around the world, to foster transfer to knowledge users.</td>
</tr>
<tr>
<td>Noskov</td>
<td>BROMOC3.1, a program for simulations of ion and DNA dynamics in nanopores</td>
</tr>
<tr>
<td>Swan</td>
<td>Canadian Hybrid Residential End Use Energy and GHG Emissions Model (CHREM)</td>
</tr>
<tr>
<td>Karttunen</td>
<td>CASHEW: <a href="http://www.softsimu.org/downloads.shtml">http://www.softsimu.org/downloads.shtml</a></td>
</tr>
<tr>
<td>Laurendeau</td>
<td>CFD multiphase flow licensed to PSL a UBC spin-off company</td>
</tr>
<tr>
<td>Salcudean</td>
<td>CFFC: The Computational Framework for Fluids and Combustion’s (CFFC) is an in-house computer software and/or research code developed by Groth's research group. CFFC is a package of subroutines for solving fluid dynamics and combustion problems using numerical methods and high-performance computing systems. The computational framework includes a parallel, implicit, AMR, finite-volume, discretization scheme for the solution of the compressible form of the Navier-Stokes equations governing multi-species reactive flows on both two- and three-dimensional domains using multi-block body-fitted mesh with treatment for detailed and reduced chemical kinetics, radiative heat transfer, soot formation and oxidation, and unsteady flame dynamics. Favre-averaged and Favre-filtered variants of the Navier-Stokes equations with appropriate modelling for the unresolved and subfilter-scale turbulence and turbulence-chemistry interactions can also be solved for performing both RANS- and LES-based simulations of premixed and non-premixed turbulent combusting flows. This computational framework will provide the basis for the research outlined in this allocation request. The CFFC software has already been implemented and used on both the SciNet Tightly Coupled System (TCS) and General Purpose Cluster (GPC) facilities and its parallel performance is discussed in a number of the references/publications given in the review of progress to follow.</td>
</tr>
<tr>
<td>Thomson</td>
<td>CF Flame</td>
</tr>
<tr>
<td>Winslow</td>
<td>Computational Model for Cerebral Blood Flow/Metabolism</td>
</tr>
<tr>
<td>Roger</td>
<td>CONCATERPILLAR FUNDI</td>
</tr>
<tr>
<td>Wang</td>
<td>CONTAM, CONTAM97/R, CFD0, COSMO</td>
</tr>
<tr>
<td>Poirier</td>
<td>Continued development of MUNgauss</td>
</tr>
<tr>
<td>Salahub</td>
<td>Continued updates to the deMon2k molecular modeling software</td>
</tr>
<tr>
<td>Thomas</td>
<td>Contributed to &quot;Panseq&quot; (<a href="http://lfz.corefacility.ca/panseq/">http://lfz.corefacility.ca/panseq/</a>) which was produced in collaboration with Dr. Vic Gannon of the Public Health Agency of Canada and Chad Laing (PhD Graduate Student)</td>
</tr>
<tr>
<td>Waldispuhl</td>
<td>CreateFibril (<a href="http://amyloid.cs.mcgill.ca/">http://amyloid.cs.mcgill.ca/</a>)</td>
</tr>
<tr>
<td>Shah</td>
<td>Currently working on simulation to test EnKF algorithms.</td>
</tr>
<tr>
<td>Ward</td>
<td>Custom Matlab scripts to perform compute-intensive analyses of EEG/MEG data.</td>
</tr>
<tr>
<td>Passi</td>
<td>Data Integration system; Decision Support System for Colorectal Cancel Follow-up program</td>
</tr>
<tr>
<td>Chakravarty</td>
<td>Deformation based morphometry algorithms</td>
</tr>
<tr>
<td>Frolov</td>
<td>DEFROST <a href="http://www.sfu.ca/physics/cosmology/defrost/">http://www.sfu.ca/physics/cosmology/defrost/</a></td>
</tr>
<tr>
<td>Gauthier</td>
<td>Developement and implementation of variational data assimilation systems, 3D-Var (1997)</td>
</tr>
</tbody>
</table>
and 4D-Var (2005), for the Meteorological Service of Canada that owns the software. It is still used to produce the meteorological analyses by MSC.

Zingg
diablo (CFD) jetstream (aerodynamic shape optimization)

Otto
diversitree (package in R)

Goldberg
DKG (distributed key generation), cudadl, BridgeSPA, Sphinx, Percy++, Off-the-Record Messaging (OTR)

Guthrie
DONBT, a set of programs to calculate rate constants for chemical reactions by No Barrier Theory

Hamilton-Wright
DQEmgBridge: link between existing DQEMG program and the Sierra Wave II

gas
EcoSim

Krems
Efficient method for quantum calculations of molecule - molecule scattering properties in a magnetic field

Deslongchamps
EM-Dock: reverse-docking program, runs within the Molecular Operating Environment (MOE, Chemical Computing Group, Inc.) GI-MOE: Gaussian interface for MOE, runs within the Molecular Operating Environment (MOE, Chemical Computing Group, Inc.) Post-Dock: a program for the visualization of molecular docking results, runs within the Molecular Operating Environment (MOE, Chemical Computing Group, Inc.)

John
EMTL MicroVolt

Ternovska
Enfragmo system

Tsanis

Charbonneau
EULAG-MHD

Schurr
FBAT-dosage

Shipley
FD package in R

Fafard
FESh++

Laprise
Fifth-generation Canadian Regional Climate Model (CRCM5)

tanaka
fiTQun: new reconstruction algorithm for Super-Kamiokande and other water cherenkov detectors

secanell
Fuel Cell Simulation Toolbox (FCST)

Starosta
GEANT4 radiation transport code for a neutron generator laboratory at Simon Fraser University GEANT4 simulation of shielded, high-resolution, photon detector (HpGe) for environmental and radioactivity studies.

Chen
genBlastA, genBlastG, OrthoCluster, OrthoClusterDB, CooVar

Trépanier
Geometric parameterization of fan blades Far-field Drag decomposition for full aircraft

Chao
Global optimization program based on parallelized genetic algorithm for design of accelerator and beam transport systems of arbitrary configuration topology.

Després
GPUMCD (see publications), licensed to IMPAC Medical Systems

Fan
grid/cloud based reconfigurable computing platform

Gerhard
GW-VAP3D: A 3D coupled groundwater-vapour contaminant transport model for studying the implications of industrial subsurface pollution on the risk to receptors in the neighbouring community

Molson
Heatflow, BioNAPL, Flonet

Goodenough

Morozov
http://seisweb.usask.ca/igeos/index.html

Bouchard-Côté
http://www.stat.ubc.ca/~bouchard/GEP/

Chen
Idefics Dynamic

Munroe
igwtools

Aubé
ILLUMINA light pollution model AODSEM particulate transport model SAND spectrometer software package

Sloan
Image analysis software described in T. Kuhn, I. Grishin, J. J. Sloan, "Improved Imaging
<table>
<thead>
<tr>
<th>Name</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demirov</td>
<td>Implementation of Global Ocean Model with two-ways nested high-resolution model of the Nordic Seas. Implementation of North Ocean Model with two-ways nested high-resolution model of the Labrador Sea</td>
</tr>
<tr>
<td>Lewis</td>
<td>In house statistical analysis.</td>
</tr>
<tr>
<td>Habashi</td>
<td>In-flight icing simulation software</td>
</tr>
<tr>
<td>Crawford</td>
<td>In-house coupled aerodynamics &amp; structures code for wind turbine multidisciplinary optimization</td>
</tr>
<tr>
<td>Brinkman</td>
<td>InnateDB, MicrobeDB, IslandViewer, Allergy and Asthma Portal</td>
</tr>
<tr>
<td>Soulet</td>
<td>Intravital imaging Toolbox (macro programme pour le logiciel ImageJ)</td>
</tr>
<tr>
<td>Najmanovich</td>
<td>IsoMIF</td>
</tr>
<tr>
<td>Peng</td>
<td>JMTT, an R package for joint modeling of longitudinal measurements and survival times with a cure fraction</td>
</tr>
<tr>
<td>German</td>
<td>Jea: <a href="http://github.com/dmgerman/joa">http://github.com/dmgerman/joa</a></td>
</tr>
<tr>
<td>Zuckermann</td>
<td>Langevin dynamics numerical simulation for multipedal synthetic protein mmotor models. Monte Carlo numerical simulation for coupled synthetic molecular nano-motors.</td>
</tr>
<tr>
<td>Anderson</td>
<td>LegUp high-level synthesis framework was partially created using Compute Canada resources: <a href="http://www.legup.org">www.legup.org</a></td>
</tr>
<tr>
<td>Duncan</td>
<td>LIPAD - a Langrangian Integrator for Planetary Accretion and Dynamics</td>
</tr>
<tr>
<td>Newman</td>
<td>LMERConvenienceFunctions: A suite of functions to back-fit fixed effects and forward-fit random effects, as well as other miscellaneous functions (<a href="http://cran.r-project.org/web/packages/LMERConvenienceFunctions/index.html">http://cran.r-project.org/web/packages/LMERConvenienceFunctions/index.html</a>)</td>
</tr>
<tr>
<td>Li</td>
<td>LoopWeaver</td>
</tr>
<tr>
<td>Kaplan</td>
<td>LPJ-LMfire parallelized dynamic global vegetation model</td>
</tr>
<tr>
<td>Harrison</td>
<td>LPS-annotate compositional bias analysis server (<a href="http://libaio.biol.mcgill.ca/lps-annotate.html">http://libaio.biol.mcgill.ca/lps-annotate.html</a>)</td>
</tr>
<tr>
<td>Van Houten</td>
<td>Magnetic Resonance Elastography Subzone Image Reconstruction Multi-Scale Cell Mechanics Model</td>
</tr>
<tr>
<td>Marchand</td>
<td>Many learning algorithms for constructing predictors from data.</td>
</tr>
<tr>
<td>Yau</td>
<td>Mars ionosphere simulation code created</td>
</tr>
<tr>
<td>Gebali</td>
<td>matlab for video compression</td>
</tr>
<tr>
<td>Mongeau</td>
<td>MCAAP (McGill Computational Aeroacoustics Package) (Acoustic analogy)</td>
</tr>
<tr>
<td>Lerch</td>
<td>MICE-build-model: registration software for MRI scans MAGeT: segmentation software for MRI scans</td>
</tr>
<tr>
<td>Evans</td>
<td>Minc format and Toolkit, CBRAIN Distributed Collaborative Platform, BrainBrowser 3D Web Viewer, LORIS Multi-Site Study Database.</td>
</tr>
<tr>
<td>Schreckenbach</td>
<td>Minor contributions to the ADF code (<a href="http://www.scm.com">http://www.scm.com</a>)</td>
</tr>
<tr>
<td>Lister</td>
<td>Model of localised corrosion in a nozzle-inserted tube.</td>
</tr>
<tr>
<td>Galanis</td>
<td>Models for ice rinks and ejector refrigeration systems</td>
</tr>
<tr>
<td>Larsson</td>
<td>modifications to BEAST, RAXML, and Mr.Bayes</td>
</tr>
<tr>
<td>Myers</td>
<td>Modifications to NEMO ocean /sea-ice general circulation model. Fortran and matlab</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Haljan</td>
<td>Molecular dynamics simulation code has been written in MATLAB to investigate non-equilibrium dynamics of trapped arrays of atomic ions. The simulations have been used to compare to experiments measuring topological defect formation following a quench across the linear-zigzag structural phase transition.</td>
</tr>
<tr>
<td>Baroud</td>
<td>Most related to PhD studies for micro-structural analysis of bone substitute</td>
</tr>
<tr>
<td>Chen</td>
<td>Multiscale ensemble data assimilation system</td>
</tr>
<tr>
<td>Kim</td>
<td>MUSI -- see publication</td>
</tr>
<tr>
<td>Jeon</td>
<td>MUSIC and MUSIC with UrQMD Afterburner. Both are relativistic heavy ion collision simulators.</td>
</tr>
<tr>
<td>Lu</td>
<td>Nahanni system for Linux KVM, known in the mainline as ivshmem.</td>
</tr>
<tr>
<td>Wartak</td>
<td>NEGF simulator of semiconductor lasers</td>
</tr>
<tr>
<td>Eliasmith</td>
<td>Nengo</td>
</tr>
<tr>
<td>Rutherford</td>
<td>NepidemiX - Software package for modelling diseases processes on networks. See: <a href="http://nepidemix.irmacs.sfu.ca">http://nepidemix.irmacs.sfu.ca</a> NepidemiX is published under the modified BSD license. It may be downloaded from the above website.</td>
</tr>
<tr>
<td>Tieleman</td>
<td>New analysis software for membrane simulations</td>
</tr>
<tr>
<td>Betz</td>
<td>New flow to generate large benchmarks, and a new much larger and more realistic suite of benchmark circuits, to test FPGA CAD software and new architectures. Publication in preparation for the IEEE Int. Conf. on Field Programmable Logic and Applications.</td>
</tr>
<tr>
<td>Forman-Kay</td>
<td>New version of ENSEMBLE</td>
</tr>
<tr>
<td>Marshall</td>
<td>No commercial code. Only research software, for glacier, ice sheet, and glacier-climate modelling.</td>
</tr>
<tr>
<td>Wachowiak</td>
<td>Non-commercial web-based research system for visualization and agricultural decision support. Supported by NOHFC grant above.b <a href="http://geovisage.nipissingu.ca">http://geovisage.nipissingu.ca</a></td>
</tr>
<tr>
<td>Cardille</td>
<td>None that is commercialized. Only in-house software</td>
</tr>
<tr>
<td>Ray</td>
<td>NSGA program</td>
</tr>
<tr>
<td>Rankin</td>
<td>Numerous computer models describing space plasma interactions in solar system plasmas</td>
</tr>
<tr>
<td>Cronk</td>
<td>Numerous custom scripts in perl and R</td>
</tr>
<tr>
<td>Lu</td>
<td>Ocean circulation and sea-ice models based on NEMO for global, North Atlantic, Arctic and Northwest Pacific Oceans based on NEMO (Nucleus for European Modelling of the Ocean)</td>
</tr>
<tr>
<td>gray</td>
<td>OFR-AT : Analysis tool for extracting potentials of mean force from force samplings obtained from non-equilibrium molecular dynamics simulations, developed by graduate student Bryan Holland (<a href="http://dx.doi.org/10.1016/j.jcp.2012.02.018">http://dx.doi.org/10.1016/j.jcp.2012.02.018</a>).</td>
</tr>
<tr>
<td>Tomberli</td>
<td>OFR-AT v1.0</td>
</tr>
<tr>
<td>Bayne</td>
<td>Online database system reporting bird density from models created for entire North American continent <a href="http://www.borealbirds.ca">www.borealbirds.ca</a></td>
</tr>
<tr>
<td>Pharoah</td>
<td>Open Source multi-scale software suite built on OpenFoam for Solid Oxide Fuel Cell modelling</td>
</tr>
<tr>
<td>Brown</td>
<td>OrlandoVision, or OVis, is a tool used to leverage semantic XML tags in text corpora to visualize connections between persons according to the type of relationship.</td>
</tr>
<tr>
<td>soulez</td>
<td>ORS</td>
</tr>
<tr>
<td>van Veen</td>
<td>PAMPAC, MFM</td>
</tr>
<tr>
<td>Halevy</td>
<td>Parametric recoverability toolkit (in development)</td>
</tr>
<tr>
<td>Hoos</td>
<td>ParamILS (UBC UILO), SMAC (UBC UILO)</td>
</tr>
<tr>
<td>Liang</td>
<td>pBWA</td>
</tr>
<tr>
<td>Zhang</td>
<td>Phenom.cebr.utoronto.ca RIP-Seeker</td>
</tr>
<tr>
<td>Driot</td>
<td>PICS, rGADEM, rTANDEM, MoTIV</td>
</tr>
<tr>
<td>Bénard</td>
<td>PIGCMC-Sim</td>
</tr>
<tr>
<td>Kusalik</td>
<td>PIIKA, DAPPLE, SAPHIRE</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sheng</td>
<td>Plateform of fully coupled Comsol multiphysics radio-frequency and structural mechanics modules for computing the cell deformation in dual-beam optical tweezers.</td>
</tr>
<tr>
<td>Tarasov</td>
<td>plenty has been created for inhouse use, but none has been commercialized</td>
</tr>
<tr>
<td>Boucher</td>
<td>Plug-in for Geneious</td>
</tr>
<tr>
<td>Bowling</td>
<td>Polaris: Limit Texas Hold’em Player Polaris: No-Limit Texas Hold’em Player Arcade Learning Environment</td>
</tr>
<tr>
<td>Beaulieu</td>
<td>Postdoctoral fellow is developing software to enable the measurement of diffusion magnetic resonance imaging (MRI) parameters along the length of white matter tracts in the human brain.</td>
</tr>
<tr>
<td>Becke</td>
<td>postG.f (for the addition of dispersion energies and forces to GAUSSIAN03 computations)</td>
</tr>
<tr>
<td>Fortin</td>
<td>Poursuite du développement de notre logiciel d'éléments finis maison appelé MEF++.</td>
</tr>
<tr>
<td>Bhiladvala</td>
<td>Programs for Steady and unsteady CFD calculations for turbulent wall shear stress probes.</td>
</tr>
<tr>
<td>Yevick</td>
<td>proprietary software pertaining to optical system simulation</td>
</tr>
<tr>
<td>Marchand</td>
<td>Petra This is a PIC simulation that I developed to simulate satellite-space environment interaction, and that I also use to simulate laboratory plasma interaction. This model is continually being improved and enhanced.</td>
</tr>
<tr>
<td>Austin</td>
<td>Python code for tracking clouds in large eddy simulations: <a href="https://github.com/phaustin/cloudtracker">https://github.com/phaustin/cloudtracker</a></td>
</tr>
<tr>
<td>Peterman</td>
<td>R code to conduct the Monte Carlo simulations reported in the Dorner et al. manuscript that is still under review at the journal, Fisheries Research.</td>
</tr>
<tr>
<td>Bureau</td>
<td>R package LCAextend</td>
</tr>
<tr>
<td>Coady</td>
<td>Ran Mahout for data analysis, but not software created other than testing.</td>
</tr>
<tr>
<td>Corbeil</td>
<td>Ray, Ray meta. Ray cloud Browser</td>
</tr>
<tr>
<td>Ling</td>
<td>Recommendation systems Big Data Analytics</td>
</tr>
<tr>
<td>Mostaghimi</td>
<td>RF plasma simulation software</td>
</tr>
<tr>
<td>Robertson</td>
<td>Rigaudon, Polytonic Greek OCR <a href="https://github.com/brobertson/rigaudon">https://github.com/brobertson/rigaudon</a></td>
</tr>
<tr>
<td>Yu</td>
<td>Rmpi: R package. One of two cores packages designed by High-Performance and Parallel Computing with R Community. Rmpi is used on SHARCNET for MPI statistical computing. pbdMPI: R package with a focus on Single Program/Multiple Data (SPMD) parallel programming style.parspatstat: R package for parallel spatial statistics</td>
</tr>
<tr>
<td>Nair</td>
<td>SAObib: a library for surrogate-assisted design optimization</td>
</tr>
<tr>
<td>Gu</td>
<td>Seismic Digital Processing Softwares (for UofA students and Faculty) Seismic Radon Transform Method (downloadable at journal software depository of Computers and Geosciences)</td>
</tr>
<tr>
<td>Rogan</td>
<td>Shannon pipeline for human mRNA splicing mutation analysis (patented, commercialized) Automated Splice site and exon definition analysis (patent pending, commercialized) Automated dicentric chromosome identifier (patent pending)</td>
</tr>
<tr>
<td>Tyson</td>
<td>Simulation software for random walks on circular or rectangular domains. The software is described in the MSc thesis of Alexander Blaessle (in progress).</td>
</tr>
<tr>
<td>Hudson</td>
<td>Simulations of weak lensing around satellite galaxies in groups</td>
</tr>
<tr>
<td>Renksizbulut</td>
<td>Software developed for DSMC simulations of rarefied reacting flows in micro/nano channels.</td>
</tr>
<tr>
<td>James</td>
<td>software for computing glacial isostatic adjustment (GIA) continues to be improved and updated.</td>
</tr>
<tr>
<td>Sarkar</td>
<td>software for large-scale stochastic PDE simulation software for data assimilation for large-scale stochastic PDE</td>
</tr>
<tr>
<td>Yeung</td>
<td>Software for modelling sedimentation of nano-particles in non-aqueous liquids</td>
</tr>
<tr>
<td>PI Last Name</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Boisvert</td>
<td>Software: Ray Platform, Ray (Ray Meta), Ray Cloud Browser</td>
</tr>
<tr>
<td>Rochefort</td>
<td>SPAGS-STM, Flex-STM, HPN (Hybrid Percolation Network)</td>
</tr>
<tr>
<td>Tse</td>
<td>Structural prediction with evolution algorithm (with former student Dr. Y. Yao)</td>
</tr>
<tr>
<td>Donovan</td>
<td>synchronization routines to manage the accuracy of our primary and secondary data sets</td>
</tr>
<tr>
<td>Makarenkov</td>
<td>T-Rex: a web server for inferring, validating and visualizing phylogenetic trees and networks (available at: <a href="http://www.trex.uqam.ca">www.trex.uqam.ca</a>)</td>
</tr>
<tr>
<td>Trescases</td>
<td>The Compute Canada resources have proved crucial to Blue Sky Solar Racing project where the students get a chance to design, build and race solar vehicles. The compute servers were primarily used to run ANSYS CFX that determined the aerodynamic drag of the designed solar vehicle. The server allowed us to run the analysis at 2-3 times the speed of a regular desktop machine and it also allowed us to run multiple runs of ANSYS software concurrently, speeding up the design process even more. We are in the process of gathering further aerodynamic drag results using the compute servers for developing an accurate strategy for the upcoming race in October.</td>
</tr>
<tr>
<td>Moitessier</td>
<td>The Forecaster platform: FITTED, Prepare, Process, Smart, Convert, Select, Reduce, React, Finders, Impacts, ACE.</td>
</tr>
<tr>
<td>Levesque</td>
<td>The genome typing by sequencing IBIS pipeline</td>
</tr>
<tr>
<td>Hore</td>
<td>Tools for the modelling of peptide structures in solution and at surfaces. Tools for predicting IR, Raman, and SFG spectra of these molecules. Grid computing tools for managing the above tasks.</td>
</tr>
<tr>
<td>Santos</td>
<td>UNB Ray-tracer UNB-VMF1 service</td>
</tr>
<tr>
<td>Inal</td>
<td>User Defined Material Subroutines (UMATs) for various softwares</td>
</tr>
<tr>
<td>Foreman</td>
<td>versatile harmonic tidal analysis package</td>
</tr>
<tr>
<td>Paus</td>
<td>Volumetric analysis pipeline</td>
</tr>
<tr>
<td>Irons</td>
<td>We are developing software for CFD calculations in steelmaking; student is progressing well, and will be presenting his first conference paper in May.</td>
</tr>
<tr>
<td>Coulombe</td>
<td>We are in the process of developing a parallel program for nanofluids simulations at the microscopic scale. The use of the Compute Canada infrastructure has been paramount in this developing stage. The hybrid model being developed uses the Lattice Boltzmann Method (LBM) to describe the fluid and the fluid-particle interactions, while the Finite Element Finite Volume method is used describe the conservation equations for energy and species. The model development stage has been completed and we are currently validating the model.</td>
</tr>
<tr>
<td>Wodak</td>
<td>We created MRR (Multiple Replica Repulsion) algorithm for sampling conformational landscapes of complex biological systems (protein-ligand in explicit water). The software was developed as a pug-in to the CHARMM package.</td>
</tr>
<tr>
<td>Lignos</td>
<td>We developed a unix-based software for finite element simulation of frame structures.</td>
</tr>
<tr>
<td>Beaumont</td>
<td>We have been modifying the software Douar a 3D finite element program for fluid creeping flows.</td>
</tr>
<tr>
<td>Militzer</td>
<td>We have been working for over 12 years on the development of an in house Computational Fluid Dynamics software named the Numerical Wind Tunnel. Recently improvements allow for the accurate prediction of flow velocities in the boundary layer around solid objects. This work is part of the MASc thesis of Mr. Fang Gao.</td>
</tr>
<tr>
<td>Christensen</td>
<td>We have developed a first and very data-intensive model of life in the global ocean. Will be published during 2013.</td>
</tr>
<tr>
<td>Clarke</td>
<td>ZEUS-3D, version 3.6 AZEuS</td>
</tr>
</tbody>
</table>

**Collaborations**

<table>
<thead>
<tr>
<th>PI Last Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanley</td>
<td>Collaborations with researchers at MIT, Caltech, and Harvard University.</td>
</tr>
<tr>
<td>Eikerling</td>
<td>German-Canadian collaboration program in fuel cell research- Pan-Canadian network on Catalysis Research for Polymer Electrolyte Fuel Cell- APC project on membrane degradation- NSERC CRD project on catalyst layer degradation with AFCC- NSERC SPG project on design and fabrication of ultrathin catalyst layers with partners at SFU, Queen's, U Alberta, AFCC, Ballard - industrial collaborations with AFCC, Ballard, Nissan, Cadex, Ford, Daimler</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Babul</td>
<td>(1) Modeling Evolution of Satellite Galaxies: Lucio Mayer (Zurich),(2) Formation and Evolution of Groups and Clusters of Galaxies: Romeel Dave (Capetown), Neal Katz (UMass), Tom Quinn (UWashington), (3) Impact of Black Hole Feedback on Galaxies, Groups and Clusters: Andrew Benson (Carnegie Obs.)</td>
</tr>
<tr>
<td>Schade</td>
<td>The Canadian Advanced Network for Astronomy Research (CANFAR) and the Canadian Astronomy Data Centre (CADC) are partners or collaborators with most major astronomy data centres in the U.S., Asia, Australia, and Europe. CANFAR/CADC manage data under contract,MOU, or other agreement with international observatories, the Gemini Observatories, the Canada-France-Hawaii Telescope, the James Clerk Maxwell Telescope, the Hubble Space Telescope, and other facilities and projects.</td>
</tr>
<tr>
<td>Attia</td>
<td>1- Industrial collaboration with Pratt&amp; Whitney Canada; modeling of machining-induced residual stresses.2- International Industrial Collaboration with Tecnolub Systems; CFD modeling of mist flow. 3- International industrial collaboration; modeling of composites machining.</td>
</tr>
<tr>
<td>Plettner</td>
<td>1. With the Canadian Forest Service 2. With a researcher in Israel 3. With a researcher in Prince George, B. C. 4. With a colleague at SFU (Biological Sciences) 5. With a colleague at SFU (Chemistry) 6. With a colleague at TWU and SFU (Chemistry)</td>
</tr>
<tr>
<td>Shaw</td>
<td>1. Collaboration with UPPA Department of Chemistry on intermolecular vibration mode identification in crystals. Participants include Prof. Isabelle Baraille and Dr. Didier Begue (UPPA, France) and Prof. J. M. Shaw and Dr. Faustine Spillebout (UofA, Canada) 2. Collaboration with UPPA Department of Applied Physics on real-time two dimensional mapping of flow and composition in porous media. Participants include Prof. Jean-Luc Daridon (UPPA France) and Prof. J. M. Shaw and Dr. Marc Cassiede (UofA, Canada)</td>
</tr>
<tr>
<td>Krzymien</td>
<td>1. TELUS Communications. 2. Huawei Technologies. 3. German Aerospace Center, Institute of Communications &amp; Navigation, Oberpfaffenhofen, Germany. 4. Department of Information Engineering, University of Padova, Padua, Italy.</td>
</tr>
<tr>
<td>Hopkins</td>
<td>AB Sciex Dr. Stuart Mackenzie, University of Oxford</td>
</tr>
<tr>
<td>Rogers</td>
<td>ADF Group Inc, Terrebonne QC</td>
</tr>
<tr>
<td>bohle</td>
<td>ADF groupe inc.</td>
</tr>
<tr>
<td>Gervais</td>
<td>Adrian Del Maestro, University of Vermont</td>
</tr>
<tr>
<td>Gosselin</td>
<td>Alcoa, SNC-Lavalin, Hatch, BPR-Tetra tech, Société d'habitation du Québec, etc.</td>
</tr>
<tr>
<td>Steffan</td>
<td>Altera Toronto</td>
</tr>
<tr>
<td>Yudin</td>
<td>AstraZeneca, Merck, Pfizer, GlaxoSmithKline</td>
</tr>
<tr>
<td>Pinfeld</td>
<td>ATLAS, MoEDAL, SLIM</td>
</tr>
<tr>
<td>Skorek</td>
<td>Bombardier Aerospace Polish-Japanese Institute of Information Technology (Poland) Bialystok University of Technology (Poland) Silesian University of Technology (Poland)</td>
</tr>
<tr>
<td>Walker</td>
<td>Ca' Foscari University of Venice</td>
</tr>
<tr>
<td>Cowen</td>
<td>Caleb Gardner, University of Tasmania; Byron Morgan, University of Kent; Takis Besbeas, University of Kent</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td>Broderick</td>
<td>CDC Neurotoxicology Laboratory, US Veterans Affairs Medical Center - Miami, University of Miami</td>
</tr>
<tr>
<td>Deza</td>
<td>Chair of the Fields Institute Industrial Optimization Seminar Series</td>
</tr>
<tr>
<td>Chen</td>
<td>China University of Petroleum, Computer Modelling Group Ltd.</td>
</tr>
<tr>
<td>Wen</td>
<td>CMC project in collaborations with Heriot-Watt University Biofuel Net project in collaborations with Dr. Ngoc Ha</td>
</tr>
<tr>
<td>Pfeiffer</td>
<td>Collaboration to Simulate extreme Spacetimes (SXS). Cornell University, California Institute of Technology, Fullerton University, University of Washington.</td>
</tr>
<tr>
<td>Li</td>
<td>Collaboration with Harbin institute of Technology, US Department of Energy</td>
</tr>
<tr>
<td>Minev</td>
<td>Collaboration with a group in the Fraunhofer Institute for Industrial Mathematics, Kaiserslautern, Germany (started in 2011). Collaboration with a group in the Department of Chemical Engineering, Institute of Chemical Technology, Mumbai, India (started in 2009). Industrial collaboration with Larichina Energy, Calgary (just starting).</td>
</tr>
<tr>
<td>Guglielmo</td>
<td>Collaboration with Bird Studies Canada through a MITACS doctoral fellowship for Tara Crewe</td>
</tr>
<tr>
<td>Schafer</td>
<td>Collaboration with Computational Laboratory of Montpellier University/CNRS</td>
</tr>
<tr>
<td>Vengallatore</td>
<td>Collaboration with Cornell University, USA, for the design of high-Q nanomechanical resonators for hybrid quantum systems.</td>
</tr>
<tr>
<td>Brisson</td>
<td>Collaboration with Ddefense Canada, RDDC-Valcartier (Hakima Abou-Rachid)</td>
</tr>
<tr>
<td>Higgins</td>
<td>Collaboration with European Space Agency on &quot;Percolating Reactive Waves in Particulate Suspensions&quot; project.</td>
</tr>
<tr>
<td>Short</td>
<td>Collaboration with Hamburg Observatory of Hamburg University, Germany</td>
</tr>
<tr>
<td>Thompson</td>
<td>Collaboration with Infonaut to produce SIMID tool for simulation of disease outbreaks (MITACS Accelerate funded)2008-2011</td>
</tr>
<tr>
<td>Liu</td>
<td>collaboration with marine geology and geophysics scientists at Woods Hole Oceanographic Institution, MA, USA</td>
</tr>
<tr>
<td>Cowling</td>
<td>Collaboration with NSF/NASA grant to Joel Cracraft on Amazonian Biodiversity. A new Ph.D. student will start with me in September 2013 and so some of his projects will involve this collaboration. Please note that no money is forthcoming from this grant, except for funding of annual workshops and meetings.</td>
</tr>
<tr>
<td>Dong</td>
<td>collaboration with Prof. Houk at UCLA</td>
</tr>
<tr>
<td>Percival</td>
<td>Collaboration with Prof. Robert West, Organosilicon Research Center, University of Wisconsin-Madison.</td>
</tr>
<tr>
<td>Currie</td>
<td>Collaboration with University of Arizona and ExxonMobil Upstream Research Company (COSA project)</td>
</tr>
<tr>
<td>Timofeev</td>
<td>Collaboration with University of New South Wales at Australian Defense Force Academy, Canberra, Australia on unsteady shock propagation and reflection</td>
</tr>
<tr>
<td>Neale</td>
<td>Collaborations with General Motors of Canada</td>
</tr>
<tr>
<td>Sushama</td>
<td>Collaborations with Ouranos consortium and HydroQuebec International collaborations with the Swedish Meteorological and HYdrological Institute (SMHI) and the Indian Institute of Science (IISe)</td>
</tr>
<tr>
<td>Lewis</td>
<td>Collaborations with two major agricultural biotechnology companies.</td>
</tr>
<tr>
<td>Kirshbaum</td>
<td>Compute Canada resources are allowing me to collaborate with Environment Canada on a project involving ensemble forecasting of convective storms. It is also supporting a collaboration with scientists at Université Joseph Fourier in Grenoble, France.</td>
</tr>
<tr>
<td>NGO</td>
<td>Consortium de recherche et d'innovation en aérospatiale au Québec (CRIAQ)</td>
</tr>
<tr>
<td>Larachi</td>
<td>Consortium de recherche minérale (COREM)</td>
</tr>
<tr>
<td>Lamoureux</td>
<td>Consortium for Research in Elastic Wave Exploration Seismology (CREWES.org)</td>
</tr>
<tr>
<td>Gakwaya</td>
<td>CRIAQ COMPRI11 Inl'l</td>
</tr>
<tr>
<td>Derome</td>
<td>CRSNG-SEP (Engagement Partenarial) lallemand. 2012-2013.</td>
</tr>
<tr>
<td>Smith</td>
<td>Czech Academy of Sciences, Prague, Czech Republic J. E. Purkinje University, Usti Nad</td>
</tr>
<tr>
<td>Labem, Czech Republic</td>
<td>Un. of Guanajuato, Leon Campus, Leon, Mexico</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Ehling</td>
<td>Daniele Werck-reichhart, CNRS,IBM, Strasbourg, France</td>
</tr>
<tr>
<td>Woolhouse</td>
<td>Data sharing and cooperation agreement with the Nokia Corporation</td>
</tr>
<tr>
<td>McDonald</td>
<td>DEAP-3600 Scientific Collaboration  SNO+ Scientific Collaboration</td>
</tr>
<tr>
<td>Zhorov</td>
<td>Denis Tikhonov, I.M. Sechenov Institute of Evolutionary Physiology and Biochemistry, Russian Academy of Sciences, St. Petersburg  Ke Dong, Michigan State University  Alexei Rossokhin, Brain Research Institute, Russian Academy of Medical Sciences, Moscow  Stephan Grissmer, Ulm University, Germany  Heike Wulff, University of California, Davis  E. Carosatti, Dipartimento di Chimica, Università degli Studi di Perugia, Italy</td>
</tr>
<tr>
<td>Apel</td>
<td>Diavik Diamond Mine</td>
</tr>
<tr>
<td>Alisaraie</td>
<td>Dr. Gregor Fels, Germany  Dr. Maria Adelaida Gomez, Colombia</td>
</tr>
<tr>
<td>Canal</td>
<td>Dr. Ponndurai Ramasami, Department of Chemistry, University of Mauritius, Mauritius</td>
</tr>
<tr>
<td>Moreau</td>
<td>Ecole Centrale de Lyon, Ecully, France  CERFACS, Toulouse, France  Siegen, Germany  Institut von Karman (VKI), Bruxelles, Belgique  Stanford University, Stanford, USA</td>
</tr>
<tr>
<td>Lien</td>
<td>Environment Canada  Defence R&amp;D Canada - Suffield  Atomic Energy Canada Limited (ACEL)  Bombardier Aerospace  Ford Canada  Natural Resources Canada (CanmetENERGY)  A.O. Smith Martec LTD.</td>
</tr>
<tr>
<td>Pineau</td>
<td>Equipe associée, INRIA-Lille</td>
</tr>
<tr>
<td>Azaiez</td>
<td>Established collaboration with the research group on Nonlinear Physical Chemistry at the Universite Libre de Bruxelles (Brussels, Belgium).</td>
</tr>
<tr>
<td>Walsh</td>
<td>EXMD Airframe Corp.  Bombardier Aerospace</td>
</tr>
<tr>
<td>Kang</td>
<td>Fédération Internationale de Football Association (FIFA)  International Olympic Committee</td>
</tr>
<tr>
<td>Beauchemin</td>
<td>Finalizing AstraZeneca collaboration. Have past collaborations with Roche Pharma and Adams Pharma. Have ongoing collaboration with Shingo Iwami at Kyushu University, Japan.</td>
</tr>
<tr>
<td>Rouleau</td>
<td>France (Dr. Christian Néri, OPMD, Paris; Dr. Vincent Meininger, ALS, Paris; Dr Stephanie Millecamp, ALS, Paris; Dr. Marie-Odile Krebs, schizophrenia, Paris), USA (Dr. Pauls, Tourette, Boston; Dr. Robert Brown, ALS, Boston; Dr. David Goldstein, epilepsy, North Carolina; Dr Eliot Sherr, agenesis, San Francisco), Australia (Dr. Garth Nicholson, ALS, Sydney; Dr. Michael Denton, schizophrenia, Brisbane; Dr Ian Blair, ALS, Sydney)</td>
</tr>
<tr>
<td>Rouat</td>
<td>France, USA, Japan, Belgium</td>
</tr>
<tr>
<td>Poole</td>
<td>Francesco Sciortino, Scuola di Roma, Italy</td>
</tr>
<tr>
<td>Karsten</td>
<td>Fundy Tidal Inc.  Fundy Ocean Research Centre for Energy  Design Systems Analysts</td>
</tr>
<tr>
<td>Liu</td>
<td>G8-Multilateral Initiative funded projects between University of Pau, France, University of Toronto and Princeton University.</td>
</tr>
<tr>
<td>Soldera</td>
<td>General Motors, American Biltrite, Channel, Defence Canada</td>
</tr>
<tr>
<td>Bear</td>
<td>GlaxoSmithKline</td>
</tr>
<tr>
<td>Olson</td>
<td>Global Alliance for the Prevention of Prematurity and Stillbirth</td>
</tr>
<tr>
<td>Landecker</td>
<td>Global Magneto-Ionic Medium Survey (GMIMS) Consortium, twenty astronomers in seven countries</td>
</tr>
<tr>
<td>Flowers</td>
<td>Helgi Bjornsson (U Iceland)  Aslaug Geirsdottir (U Iceland)  Gifford Miller (U Colorado)  Ian Hewitt (Oxford U)</td>
</tr>
<tr>
<td>Sydora</td>
<td>Helmholtz Research Centre, Forschungszentrum-Juelich, Germany  Institute for Plasma Physics, Max Planck Institute, Greifswald, Germany  Ruhr-Universitaet Bochum, Germany  Solar-Terrestrial Environment Laboratory (STELAB), Nagoya University, Japan  Department of Physics and Astronomy, University of California, Los Angeles</td>
</tr>
<tr>
<td>Clark</td>
<td>Hol-Ser Inc., Sainte-Cécile de Milton, Québec</td>
</tr>
<tr>
<td>O'Neil</td>
<td>I collaborate with the members of the international ATLAS experiment (3000 scientists from 38 countries).</td>
</tr>
<tr>
<td>Wan</td>
<td>I currently work on two projects in the field of econometrics which use SciNet. The</td>
</tr>
<tr>
<td>Name</td>
<td>Collaboration Details</td>
</tr>
<tr>
<td>--------------------</td>
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</tr>
<tr>
<td>Talman</td>
<td>I have informal collaborations with scientists at University of Florida, University of Illinois, Bordeaux University, University of Namur and the Donostia International Physics Centre. I am also collaboration on a project called Orgavolt being carried out at Grenoble and Bordeaux University.</td>
</tr>
<tr>
<td>Wilhelm-Mauch</td>
<td>IBM Watson Research Laboratories, University of Wisconsin, University of California</td>
</tr>
<tr>
<td>Sorelli</td>
<td>IFSTTAR, Paris, Lafarge, Lyon</td>
</tr>
<tr>
<td>Xi</td>
<td>In collaboration with Bombardier</td>
</tr>
<tr>
<td>Goussev</td>
<td>Industrial collaboration with GreenCentre Canada, Industrial collaboration with Givaudan Schweiz (Zurich), International collaboration with Prof. Eduardo Peris, Universitat Jaume I, Dpto. QuÃ­mica InorgÃ¡nica y OrgÃ¡nica, CastellÃ³n, Spain,</td>
</tr>
<tr>
<td>Singh</td>
<td>Industrial collaboration with Integran Technologies, funded through NSERC Engage grant.</td>
</tr>
<tr>
<td>Tullis</td>
<td>Industrial: Elastovalve, Cleanfield Energy, Two-West Wind, CANDU (AECL, Bruce, OPG)</td>
</tr>
<tr>
<td>Pratt</td>
<td>Infreeum Co. UK</td>
</tr>
<tr>
<td>Nguyen Dang</td>
<td>Institut de Sciences Moléculaires, (CNRS), Université de Paris-sud XI, Orsay, France (O. Atabek)</td>
</tr>
<tr>
<td>Feng</td>
<td>International collaboration in progress: A cell-level biomechanical model of Drosophila dorsal closure, with Len Pismen, Technion, Israel. Simulations of bubble-wall collision and rebound, with Roberto Zenit, UNAM, Mexico. Self-Propelled Jumping Drops upon Coalescence on Leidenfrost Surfaces: Experiments and Simulations, with Chuan-Hua Chen, Duke University, USA.</td>
</tr>
<tr>
<td>Soteros</td>
<td>International collaboration with Prof. Mariel Vazquez, San Francisco State University and her research group.</td>
</tr>
<tr>
<td>Barreiro</td>
<td>International collaborators: Lluis Quintana-Murci (Pasteur Institut of Paris, France), Ludovic Tailleux (Pasteur Institut of Paris, France), Yoav Gilad (University of Chicago, USA), Bana Jabri (University of Chicago, USA), Jenny Tung (Duke University, USA).</td>
</tr>
<tr>
<td>Taylor</td>
<td>International GALFACTS collaboration (45 researchers)</td>
</tr>
<tr>
<td>Ifimie</td>
<td>Jean-Francois Truchon and C. Baily, both formerly at Merck-Frosst, Canada</td>
</tr>
<tr>
<td>Sargent</td>
<td>King Abdullah University of Science and Technology</td>
</tr>
<tr>
<td>Fedosejevs</td>
<td>Lawrence Livermore National Laboratory, University of California San Diego, Ohio State University, General Atomics, California, Applied Nanotools, Edmonton</td>
</tr>
<tr>
<td>Tremblay</td>
<td>Les Laboratoires Servier France</td>
</tr>
<tr>
<td>Protas</td>
<td>Long-standing collaboration with General Motors of Canada</td>
</tr>
<tr>
<td>Bartello</td>
<td>Many</td>
</tr>
<tr>
<td>Martin</td>
<td>Many including NASA, EPA, Harvard University</td>
</tr>
<tr>
<td>Nashmi</td>
<td>Marina Picciotto</td>
</tr>
<tr>
<td>Thompson</td>
<td>Merck &amp; Co. Company</td>
</tr>
<tr>
<td>Liu</td>
<td>Messier Dowty</td>
</tr>
<tr>
<td>Eichhorn</td>
<td>Noel Clark, Department of Physics, University of Colorado at Boulder, USA; Bilal R. Kaafarani, Department of Chemistry, American University of Beirut, Beirut 1107-2020, Lebanon; Sabine Laschat, Department of Chemistry, University of Stuttgart, Germany; Yo Shimizu, Osaka National Research Institute, Osaka, Japan; MAHLE Air Filter Systems Canada in Tilbury, ON;</td>
</tr>
<tr>
<td>Pudritz</td>
<td>NSERC CREATE grant (2009 - 2015): Canadian Astrobiology Training Program (CATP); Origins Institute / McMaster is one of 4 major institutions: McGill, McMaster, Toronto, Western</td>
</tr>
<tr>
<td>Sadat</td>
<td>NSERC ENGAGE with NLP Technologies</td>
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</tr>
<tr>
<td>Francois</td>
<td>Olivier Pourquié (IGBMC Strasbourg) Alexander Aulehla (EMBL Heidelberg) Sharon Amacher (Ohio State) Eric Siggia (Rockefeller University) Massimo Vergassola (Pasteur Institute) Grégoire Altan-Bonnet (Memorial Sloan Kettering, New York)</td>
</tr>
<tr>
<td>Areibi</td>
<td>ON Semi Conductor, Waterloo, Ontario Canada AGFA, Mississauga, Ontario, Canada</td>
</tr>
<tr>
<td>Graham</td>
<td>OneKP (One Thousand Plant Transcriptomes)</td>
</tr>
<tr>
<td>Selinger</td>
<td>Our Alberta Livestock Genomics Program (ALGP) project is in collaboration with Dr. Alan Dobson from University College Cork (Cork, Ireland) and Dr. Roman Loftus from IdentiGEN Canada Ltd (Edmonton, AB) Dr. Ralf Greiner - Max Rubner Institute (Karlsruhe, Germany) - Phytate degrading enzymes</td>
</tr>
<tr>
<td>Arain</td>
<td>Participated in the North American Carbon Program (NACP) Multi-Scale Synthesis and Terrestrial Model Intercomparison (MsTMIP) Project to provide feedback to the terrestrial biosphere modeling (TBM) community in order to improve the diagnosis and attribution of carbon fluxes at regional and global scales.</td>
</tr>
<tr>
<td>Ayers</td>
<td>Patrick Bultinck, Dimitri Van Neck, Stijn De Baerdemackers, Toon Verstraeten, Paul Geerlings, Frank De Proft (Belgium) Carlos Cardenas, Patricio Fuentesalba, Alejandro Toro-Labbe, Eduardo Chamorro (Chile) Samantha Jenkins, Steven Kirk (China) Hiroshi Nakatsuji (Japan) Pratim Chattaraj (India)</td>
</tr>
<tr>
<td>Bocher</td>
<td>Philippe Bocher has worked two year at PWC as a research engineer. He is now collaborating with large (PWC, RR, Bell Helicopter, L3com, and Bombardier) and small companies (Techmnicombe, Marquez, Air Terre Equipement).</td>
</tr>
<tr>
<td>Pink</td>
<td>Prof. C. B. Hanna, Dept. of Physics, Boise State University, Boise ID, USA</td>
</tr>
<tr>
<td>Gauld</td>
<td>Prof. Christopher Franklyn (University of Vermont)</td>
</tr>
<tr>
<td>Dufresne</td>
<td>Prof. L. Bricteux (UMons, Belgium), study of swirling jet dynamics.</td>
</tr>
<tr>
<td>Szpunar</td>
<td>Prof. Usinomyma, Osaka University (Japan) Prof. Suvas, Benagalore Institute of Science and Technology (India) Prof. Dutkiewicz, Polish Academy of Science (Poland)</td>
</tr>
<tr>
<td>Tropper</td>
<td>Prof. W. Lytton, Downstate Medical Center, SUNY,NYC,NYD,USA Prof.C.Carrothers,Dept. Computer Science, RPI,Troy,NYS,USA</td>
</tr>
<tr>
<td>Wickham</td>
<td>Professor Weihua Li, Macromolecular Science, Fudan University</td>
</tr>
<tr>
<td>Leung</td>
<td>Qatar University, TELUS</td>
</tr>
<tr>
<td>Ayotte</td>
<td>Radu Iftimie (UdeM), Bruce Kay (PNNL), Philippe Parent (UPMC-AMU), Gil Alexandrowicz (Technion)</td>
</tr>
<tr>
<td>Branzan Albu</td>
<td>SAP Canada Kongsberg Mesotech</td>
</tr>
<tr>
<td>Loock</td>
<td>Since 2007 Gianluca Gagliardi, Istitute Nazionale di Ottica, Napoli, Italy: 6 joint publications Since 2012 Oliver Reich, innoFSPEC, Univ. of Potsdam, Germany: 2 joint publications 2007-2009 Michael Ashfold, Laserchemistry, University of Bristol, UK, 5 joint publications 2007-2009 Masahiro Kawasaki, Molecular Engineering, Univ. of Kyoto, Japan, 4 joint publications Industrial collaborators: GasTOPS (Ottawa, ON), Weatherford (Fort Worth, TX and Calgary, AB), IR Photonics (Montreal, QC).</td>
</tr>
<tr>
<td>Krauss</td>
<td>SNO+ experiment (members from Canada, USA, UK, Portugal, Germany). PICASSO collaboration (members from Canada, USA, Czech Republic and India).</td>
</tr>
<tr>
<td>Nogami</td>
<td>some calculations in collaboration with the University of Tokyo are still underway</td>
</tr>
<tr>
<td>Levi</td>
<td>Stanford University</td>
</tr>
<tr>
<td>Ali</td>
<td>Status and Trends of European Pollinators</td>
</tr>
<tr>
<td>Heniche</td>
<td>Sumitomo Heavy Industry Total Rheosoft</td>
</tr>
<tr>
<td>Weinberg</td>
<td>T.Asano (Japan), M.Basilevsky (Russia), R.Bini (Italy), C.Kim (Korea), K.Mislow (USA), Y.Ohga (Japan)</td>
</tr>
<tr>
<td>POUTISSOU</td>
<td>T2K</td>
</tr>
<tr>
<td>mathie</td>
<td>T2K collaboration</td>
</tr>
<tr>
<td>Trischuk</td>
<td>The ATLAS collaboration</td>
</tr>
<tr>
<td>Liu</td>
<td>The Autism Genome Project Consortium</td>
</tr>
<tr>
<td>Huber</td>
<td>Thomas Jefferson National Accelerator Facility (Newport News, USA) Institut fuer Kernphysik (Mainz, Germany)</td>
</tr>
<tr>
<td>Syvitski</td>
<td>Treventis Corporation</td>
</tr>
<tr>
<td>Name</td>
<td>Affiliation and Other Details</td>
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<tr>
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</tr>
<tr>
<td>Vincent</td>
<td>Ubisoft Montreal</td>
</tr>
<tr>
<td>Melacini</td>
<td>UCSD, BCM, NUS</td>
</tr>
<tr>
<td>Allen</td>
<td>UNESCO GRAPHIC Programme - Contact Holger Treidel Powell Centre - United States Geological Survey (collaborator) on project led by Thomas Meixner The Nature Conservancy - The Bahamas</td>
</tr>
<tr>
<td>Masson</td>
<td>Université d'Orléans</td>
</tr>
<tr>
<td>Balima</td>
<td>Université de Nantes (Yann Favennec, Benoit Rousseau)</td>
</tr>
<tr>
<td>Sarty</td>
<td>University College London, United Kingdom Konkoly Observatory, Hungary University of Sydney, Australia</td>
</tr>
<tr>
<td>Koop</td>
<td>University of Bergen (Frank Nilsen), University of As (Sigbjorn Lien) Norway University of Tasmania (Barbara Nowak) University of Chile (Alejandro Maass, Rodrigo Vidal) Chile Novartis Marine Harvest Canada</td>
</tr>
<tr>
<td>Vargas-Baca</td>
<td>University of Texas Austin, USA- Chemistry and Biochemistry - Alan H. Cowley Universidad de Alcala, Spain - Inorganic Chemistry - Marta E. Gonzalez Mosquera</td>
</tr>
<tr>
<td>Peltier</td>
<td>US National Oceanic and Atmospheric Administration Nuclear waste management Organization SUNCOR IBM</td>
</tr>
<tr>
<td>Pralat</td>
<td>Used to collaborate with Winston and Mako (2 NSERC Engage projects). Collaboration with BlackBerry and Globe and Mail (another 2 NSERC Engage projects).</td>
</tr>
<tr>
<td>Overall</td>
<td>We are collaborating with Dr Frederique Lisacek, Swiss Institute of Bioinformatics to annotate post translational modifications of protein N termini.</td>
</tr>
<tr>
<td>Raghavan</td>
<td>We are working on development of an industrial collaboration with food industries.</td>
</tr>
<tr>
<td>Plumer</td>
<td>Western Digital Corporation. USA.</td>
</tr>
<tr>
<td>Herrmann</td>
<td>Work with Ben Recht fro University of Wisconsin, Madison</td>
</tr>
<tr>
<td>Polanyi</td>
<td>Xerox Research Centre of Canada (XRCC).</td>
</tr>
<tr>
<td>Donaldson</td>
<td>Xin Gao / King Abdullah University of Science and Technology / KAUST / in bioinformatics</td>
</tr>
<tr>
<td>Bourbonnais</td>
<td>Y. Fuseya, Electrotechnic University, Tokyo, Japan M. Tsuchiizu, University of Nagoya, Nagoya, Japan</td>
</tr>
<tr>
<td>Chen</td>
<td>1. US Forest Service, US Department of Agriculture 2. Nanjing University, China</td>
</tr>
<tr>
<td>Bengio</td>
<td>Ubisoft ZeroSpam D-Wave AT&amp;T Apstat STEERads</td>
</tr>
<tr>
<td>Carrington</td>
<td>Martin Quack, ETH, Switzerland</td>
</tr>
<tr>
<td>Wu</td>
<td>in the stage of development, not finalized yet.</td>
</tr>
<tr>
<td>CA tê</td>
<td>Xavier Gonze, UCL, Belgique</td>
</tr>
<tr>
<td>Beaulieu</td>
<td>University of California at San Francisco (UCSF), Maastro Clinic in the Netherlands, Elekta van Beek IBM Canada</td>
</tr>
<tr>
<td>Eagleson</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Giroux</td>
<td>TU Bergakademie Freiberg; Saudi Aramco</td>
</tr>
<tr>
<td>Brenning</td>
<td>University of Zurich, Geographical Institute, Dr. S. Gruber - University of Vienna, Department of Geography and Regional Research, Prof. Dr. T. Glade - SNC Lavalin, Geoengineering, Dr. R. Guthrie</td>
</tr>
<tr>
<td>Noskov</td>
<td>EBS BioSciences San-Diego, Mayo Clinic Department of Molecular Medicine, VCU Biophysics, Yale University and the National Institutes of Health USA (Section of Molecular Transport), MPI Complex Systems (Germany), RMIT (Melbourne Australia)</td>
</tr>
<tr>
<td>gray</td>
<td>John Katsaras (Oak Ridge National Laboratories) - Keith Gubbins (North Carolina State University) - Edwin Taylor (MIT) - Scott Gregory (Caltech) - M. Jardine (University of St Andrews) - J-F Donati (Université de Toulouse)</td>
</tr>
<tr>
<td>Aubé</td>
<td>Active international research collaborations with research groups from China (Hefei - Anhui Institute of Optics and Fine Mechanics, Shanghai - Fudan University, Linan - Zhejiang Forestry University), Spain (Canary Island - Instituto de Astrofisica de Canarias, Madrid - Universidad Complutense, Barcelona - Universidad Politecnica de Cataluna), Slovakia (Astronomical Institute of the Slovak Academy of Sciences) and USA (Palomar observatory).</td>
</tr>
<tr>
<td>Name</td>
<td>Collaborations/Projects</td>
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<tr>
<td>--------------</td>
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</tr>
<tr>
<td>Lignos</td>
<td>ADF, Inc. DPHV Nippon Steel and Sumitomo Metal Corporation</td>
</tr>
<tr>
<td>Gu</td>
<td>Alberta Geological Survey Geological Survey of Canada MIT Taiwan National University</td>
</tr>
<tr>
<td>Salahub</td>
<td>Andreas Koster (CINVESTAV, Mexico), Annick Goursot (CNRS, Montpellier, France), Aurelien de la Lande (CNRS, Orsay, France), Helio Duarte (Belo Horizonte, Brazil), Thomas Heine (Jacobs University, Bremen, Germany) plus about 30 international research groups that are developing our deMon (density of Montreal) Density Functional Theory molecular modeling software.</td>
</tr>
<tr>
<td>Boisvert</td>
<td>Assemblathon 2 <a href="http://assemblathon.org/?tag=assemblathon2">http://assemblathon.org/?tag=assemblathon2</a> Cray Inc. Argonne National Laboratory</td>
</tr>
<tr>
<td>Myers</td>
<td>At present, my main collaborators are Igor Yashayaev (Bedford Institute of Oceanography, Dartmouth), Simon Josey (National Oceanographic Center, U.K.) and Mads Ribergaard (Danish Meteorological Institute, Denmark). My modeling research is aimed at explaining why basically all high-resolution models do a poor job of simulation salinity and freshwater in this region, the impact of the representation of eddies and topography and shelf-deep ocean exchanges of freshwater. I am also starting to get into the impact of sea-ice representation in these models as well as questions of data assimilation. This work is in conjunction with the Canadian Ice Service as part of a large CFCAS funded initiative. My main Canadian collaborators are Charles Hannah at the Bedford Institute of Oceanography (BIO) and Keith Thompson (Dalhousie). I am also an adjunct member of the European DRAKKAR Modelling consortium, based in France and Germany (collaborators include Anne-Marie Treguer, Brest, France; Bernard Barnier, Grenoble, France and Claus Boening, Kiel, Germany). Finally, I am provided the modeling component for a funded IPY project to look at the Canadian Arctic Archipelago, led by Humphrey Melling (IOS) and Simon Prinsenberg (BIO)</td>
</tr>
<tr>
<td>secanell</td>
<td>Automotive Fuel Cell Cooperation Corp.</td>
</tr>
<tr>
<td>Zingg</td>
<td>Bombardier</td>
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<tr>
<td>Hudson</td>
<td>Canada-France-Hawaii Legacy Survey</td>
</tr>
<tr>
<td>Galanis</td>
<td>Chaire CRSNG en efficacité énergétique industrielle (partenaires : Hydro Québec, Rio Tinto Alcan, Ressources Naturelles Canada)</td>
</tr>
<tr>
<td>Yevick</td>
<td>CIENA, Ottawa</td>
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<tr>
<td>Yeung</td>
<td>Collaboration with Imperial Oil Ltd.</td>
</tr>
<tr>
<td>Kim</td>
<td>Collaboration with Reflexion Pharmaceuticals (US), Technical University of Munich (Germany) and University of Toyama (Japan)</td>
</tr>
<tr>
<td>Marshall</td>
<td>Collaboration with the U.S. National Center for Atmospheric Research (NCAR), Boulder CO Collaboration with Bremen University, Germany on paleoclimate dynamics and climate (ocean-atmosphere-ice sheet) modelling. Center for Marine Environmental Sciences (<a href="http://www.marum.de/en/MARUM.html">http://www.marum.de/en/MARUM.html</a>)</td>
</tr>
<tr>
<td>Roger</td>
<td>Collaborations with: Dr. Tetsuo Hashimoto (Tsukuba University, Japan) Dr. Jeff Siblerman (Univ. Arkansas, USA) Dr. Inaki Ruiz-Trillo (Univ. Barcelona, Spain)</td>
</tr>
<tr>
<td>Levesque</td>
<td>Collaboration with biotechnology and pharmaceutical companies</td>
</tr>
<tr>
<td>Lu</td>
<td>Collaborators include Canadian Government laboratories (Fisheries and Oceans Canada, Environment Canada), Mercator-Ocean (France), State Oceanic Administration (China), Tianjin University of Science and Technology</td>
</tr>
<tr>
<td>Crawford</td>
<td>Delft University Ampair</td>
</tr>
<tr>
<td>Winslow</td>
<td>Dr Robin Cooper U of Kentucky Louisville, Ky USA</td>
</tr>
<tr>
<td>Tse</td>
<td>Dr. William Yim, iHPC Singapore Dr. Y. Liang, Professor, Kyoto University Dr. T. Iitaka, RIKEN, Japan</td>
</tr>
<tr>
<td>Fan</td>
<td>Energent Inc.</td>
</tr>
<tr>
<td>Mongeau</td>
<td>Exa Corporation, Burlington. MA, USA Pratt Whitney Canada, Longueuil, Quebec Heroux Devtek, St-Hubert, Quebec</td>
</tr>
<tr>
<td>Pharoah</td>
<td>Forchungszentrum JÃ¼lich University of Pisa NTNU, Norway Ballard Power Systems</td>
</tr>
<tr>
<td>Swan</td>
<td>Horizon Utilities Natural Resources Canada</td>
</tr>
</tbody>
</table>
I have had an ongoing exchange program with two colleagues from the Universidade Estadual de Ilha Solteira in Brazil. Several MASc. students of professors Dr. Sergio Mansur and Compute Canada facilities here at Dalhousie University.

IBM ILOG CPLEX group, Actenum Corp.

IMAGEN consortium, University of Bristol, Cardiff University, University of Oulu, University of Nottingham, MIND Network.

Industrial: Geosyntec Consultants, Dupont, Chevron, Dow Chemical International: U Strathclyde, U Edinburgh, Imperial College London, U Queensland, U of Thessoliniki, UFESP (Brazil), USP (Brazil), Arizona State U.

Institut de mecanique des fluides de Strasbourg, CFS Engineering, KTH University (Stockholm)

International collaborations: - Scientific Computing and Modeling SCM, Free University of Amsterdam, The Netherlands, Program Development Within the Environment of the ADF Suite of Programs - Profs. P. L. Arnold, J. B. Love, University of Edinburgh, UK, Polypyrrolic Actinide Macrocyclc Complexes - Drs. R. L. Martin and E. Batista, Los Alamos National Laboratory, USA, and P. L. Diaconescu, UCLA, USA, Actinide Ferrocene Diamide Complexes - Prof. H. Alkam, al-Quds University, Palestine, Computational Inorganic Chemistry - Prof. W. de Jong, Pacific Northwest National Laboratory, USA, Gas-Phase Actinide Molecules - Dr. N. Saleh, Al Ain, United Arab Emirates, Novel Hg Sensors - Dr. J. K. Gibson, Lawrence Berkeley National Laboratory, USA, Gas-Phase Actinide Chemistry - Profs. J. F. Stanton, University of Texas at Austin, USA, and J. Autschbach, SUNY Buffalo, USA, oNMR Calculations on Uranium Complexes

International joint work with groups in Germany & China, no formal (co-funded) collaborations.

John Katsaras, SNS, Oak Ridge, TN, USA

Prof John Shawe-Taylor

Kazuki Yoshizoe, Tokyo Institute of Technology, Japan, Akihiro Kishimoto, IBM Research Ireland, Dublin, Joerg Hoffmann, Universitat des Saarlandes, Germany

L'Oreal

Longstanding collaboration with the computational linguistics group at the CNR (National Research Centre), Pisa, Italy.

MOCA (Meltwater Ocean Cryosphere Atmosphere response) Network

MRE Collaboration with Prof. Keith Paulsen, Thayer School of Engineering, Dartmouth College

National Center for Atmospheric Research, Boulder, USA Multidisciplinary Center for Astrophysics (CENTRA), Lisbon, Portugal

NeuroRX research, Montreal, CA (Contract Research Organization, industrial collaboration) Biospective, Montreal, CA (Contract Research Organization, industrial collaboration) Child Mind Institute, New-York, USA (international collaboration)

new collaboration with Doug Menke at the University of Georgia

Optiwave, Imperial College

Our list of international collaborators is too large to list. Our data is used by a very large fraction of the space physics community. Some of our strongest collaborations are with; UCLA, University of New Hampshire, NASA Goddard Space Flight Center, Stanford Research Institute International, University of Maryland and the University of Alberta.

Pratt & Whitney Canada University of Southampton, UK University of Flinders, Australia

Pratt and Whitney Canada Rolls Royce Canada Westport Innovations

Prof Shawn Lin, Rensselaer Polytechnic Institute
Professor Heiner Linke, Physics, Lund University, Sweden   Professor Paul Curmi, Physics, University of New South Wales, Sydney, Australia   Dr. Elizabeth Bromley, Physics, Durham University, U.K.   Professor Dek Woolfson, Chemistry, Bristol University, U.K.   Professor Gerhard Blab, Biophysics, Utecht University, Netherlands   Professor Chi-Ming Chen, Physics, National Taiwan Normal University. These collaborators are working with me on the synthetic nano-motor project. Other collaborators are listed in the attached CV.

Satlantic Inc. University of Miami   Xiamen University   University Massachusetts Okinawa University   WetLabs, Inc. University of Texas Columbia University   Harvard University   University of North Dakota United States Navy   University of South Florida

Siemens, Cook Medical

T2K (Tokai-to-Kamioka) experiment, SK (Super-Kamiokande), DUET (Dual Use Experiment at TRIUMF)

The Tor Project, Inc., Pitney Bowes

UCLA, University of Michigan, UC Berkeley, University of Colorado, Peking University

Alcoa   SEC Carbon (Japon) Clarkson University

Rio Tinto Alcan

We collaborate with Dr Jean Braun of the Universite Joseph Fourier Grenoble, France in regard to applications and modifications to Douar

With Electric Power Research Institute.

Work closely with Environmental Monitoring Committee of Lower Athabasca

Working with Dr. H. Zhang, University College London

<table>
<thead>
<tr>
<th>PI Last Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Aubé</td>
<td>Multilayer optical interference filter for light emitting diode</td>
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<tr>
<td>Fan</td>
<td>SYSTEM AND METHOD FOR PROVIDING P2P BASED RECONFIGURABLE COMPUTING OR STRUCTURED DATA DISTRIBUTION. PCT, filed in Nov.2012</td>
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<td>Fafard</td>
<td>US Patent serial nb: 61/437,201 Title: Anode and connector for the Hall-Héroult process</td>
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</table>
Werstiuk

Ruda

Daneshmand
Amirali Toossi, M. Daneshmand and Dan Sameoto, Microwave Heating with Susceptor, US Provisional patent filed, US 61/650,931, Tec ID #2012020.

Hu

Perepichka

Turner

Cronin

Buriak

Lewis
Contributor to three: UoGuelph Ref. No. Raizada 20120308, Raizada 20120309, and Raizada 20120312

Areibi
Patent application title: ARCHITECTURE, SYSTEM AND METHOD FOR ARTIFICIAL NEURAL NETWORK IMPLEMENTATION Inventors: Medhat Moussa (Waterloo, CA) Antony Savich (Guelph, CA) Shawki Areibi (Waterloo, CA) IPC8 Class: AG06N302FI USPC Class: 706 16 Class name: Data processing; artificial intelligence neural network learning task Publication date: 2012-06-28 Patent application number: 20120166374

Yudin
Hili, R. and Yudin, A. K. ßUnprotected amino aldehydes and uses thereof (WO/2008/046232)

Alisaraie

Soldera

Olson
1. Gomez-Lopez N and Olson DM. "LEUKOCYTE ACTIVATION AND METHODS OF

Goussev

Tullis
Canted blades for vertical axis wind turbines - pending

Pratt

Loock

Perepichka

Inventions

<table>
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<tr>
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<tr>
<td>Savard</td>
<td>Discovered the Higgs Boson</td>
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<tr>
<td>Rivard</td>
<td>Invention disclosure filed Mar 2013 via TEC Edmonton(2012096)</td>
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<tr>
<td>Shapiro</td>
<td>X. Li, A. Eilam, and M. Shapiro, Efficient and facile laser isotope separation using deflection resistant states US patent application no. 61/748,402.</td>
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<td>Moghadas</td>
<td>A Smartphone Game System for Data Collection, Modelling, and Policy Actuation to Mitigate the Spread of Infectious Disease York University 2012-010</td>
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<tr>
<td>Mostaghimi</td>
<td>Metal coatings on organic substrates</td>
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<tr>
<td>Fafard</td>
<td>Nouveau concept de barres collectrices circulaires inclinées insérées dans un bloc cathodique percé sans utilisation de fonte de scellement.</td>
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<tr>
<td>Name</td>
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<td>Fan</td>
<td>P2P-based reconfigurable computing methods and system</td>
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<tr>
<td>Hoos</td>
<td>ParamILS (UBC UILO), SMAC (UBC UILO)</td>
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<td>Deslongchamps</td>
<td>Reverse-docking, a novel computational method for the study of asymmetric organocatalysis</td>
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<td></td>
<td>- Post-Dock, a novel visualization tool for the analysis of molecular docking</td>
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<td>Wodak</td>
<td>The MRR software was subject to an invention disclosure at the Hospital for Sick Children.</td>
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<td>Plotkin</td>
<td>Methods and Systems for Determining Localized Dielectric Properties of a Molecule</td>
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<td></td>
<td>Inventors: William C. Guest, Neil R. Cashman, Steven S. Plotkin, Application #: 12/952,140</td>
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<td>&quot;Methods and Systems for Predicting Misfolded Protein Epitopes&quot; Inventors: Neil R. Cashman, Steven S.</td>
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<td>Plotkin</td>
<td>Methods of Selectively detecting the presence of a compound in a gaseous medium Patent</td>
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<td>filed for US (Ref. 12-007; BP Ref. P42941US00) and Canada</td>
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<tr>
<td>Moewes</td>
<td>Methods of Selectively detecting the presence of a compound in a gaseous medium Patent filed for US</td>
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<td>(Ref. 12-007; BP Ref. P42941US00) and Canada</td>
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<tr>
<td>Bosse</td>
<td>Patent title: Gene expression profiling for prognosis of lung adenocarcinoma</td>
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<td></td>
<td>Inventors: Bossé Y, Laviolette M, Joubert J, Carrier JS.</td>
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<tr>
<td></td>
<td>Application number: 61/706,261 Filing date: September 27, 2012</td>
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<td>to StFX. License transfer being negotiated. Patent - Improved Apparatus and Method for Measuring Soil</td>
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<tr>
<td>Meunier</td>
<td>S. Patkovsky, L. Guyot, A-P Blanchard-Dionne, M. Meunier, Provisional Patent Integrated nanoplasmonics</td>
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<td></td>
<td>biosensors, Provisional US patent, 61469146 (2011)</td>
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<tr>
<td>Perepichka</td>
<td>D.F. Perepichka, A.Dadvand, A.Moiseev, F.Rosei, T.Takenobu, Luminescent organic semiconductor</td>
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<tr>
<td>Plettner</td>
<td>Two patents in review.</td>
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<tr>
<td>Lewis</td>
<td>2 new maize varieties</td>
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<td>Areibi</td>
<td>Architecture, System and Method for Artificial Neural Network Implementation Type: Grant Filed:</td>
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<td></td>
<td>December 10, 2007 Issued: January 24, 2012 Inventors: Medhat Moussa, Antony Savich, Shawki Areibi</td>
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<td>Trischuk</td>
<td>Discovery of the Higgs Boson</td>
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<td>Sushama</td>
<td>Land-Atmosphere coupling in the high-latitude regions; permafrost evolution; changes to nordic</td>
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<td></td>
<td>hydrology in a changing climate; impact of lakes on the regional climate; changes to extreme events</td>
</tr>
<tr>
<td></td>
<td>such as precipitation extremes, floods and droughts across Canada in future climate</td>
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Yudin, A. K.; Assem, N. Synthetic protein scaffolds Provisional Application 2010 (61367494); Yudin, A. K.; White, C. Amino acid-based reagents for peptide macrocyclization Provisional Application 2010 (61349864); Yudin, A. K.; Rai, V.; Hili, R. A method to insert molecular fragments into cyclic molecules Provisional Application 2010 (61349922); Hili, R. and Yudin, A. K. Cyclic amino acid molecules and methods of preparing the same Provisional Application 2010 (PCT/CA2010/000408);

Spin Off Companies

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<tr>
<th>PI Last Name</th>
<th>Description</th>
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<tr>
<td>Olson</td>
<td>PremGen Diagnostics, Inc. Livmor Diagnostics, Inc. Maternica Therapeutics, Inc.</td>
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<td>Harroun</td>
<td>Exact Delivery Inc.</td>
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<td>Chen</td>
<td>CDM 1. Canadian Forest Service, Natural Resources Canada 2. Environment Canada 3. Agri-Food Canada</td>
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<tr>
<td>Bengio</td>
<td>STEERads</td>
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<td>Eagleson</td>
<td>EK3</td>
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<td>Mostaghimi</td>
<td>Ablazeon, Inc. Simulent, Inc.</td>
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<td>Eliasmith</td>
<td>Applied Brain Research, Inc.</td>
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<td>Evans</td>
<td>Biospective</td>
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<td>Rogan</td>
<td>Cytochromax (preceded Compute Canada)</td>
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<td>Moitessier</td>
<td>Molecular Forecaster Inc.</td>
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<td>Ziegler</td>
<td>Scientific Computing and Modeling NV De Boelelaan 1083 1081 HV Amsterdam, The Netherland</td>
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<td>Netherlands</td>
<td><a href="http://www.scm.com">www.scm.com</a></td>
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<td>Yudin</td>
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<td>Risk</td>
<td>Forerunner Research Inc.</td>
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### Industrial Design

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<td>Name</td>
<td>Description</td>
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<tr>
<td>Mostaghami</td>
<td>Heat shields</td>
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<tr>
<td>Lewis</td>
<td>Underwater Radiance camera</td>
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<tr>
<td>Chao</td>
<td>TRIUMF VECC test facility</td>
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<tr>
<td>Tullis</td>
<td>Blade designs for VAWTs</td>
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<tr>
<td>Larachi</td>
<td>DFT simulations for identifying the most suitable collectors for ore flotation for the mining industry.</td>
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### Trademarks

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<td>Name</td>
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<td>Vize</td>
<td>1. Xenbase</td>
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## Outreach Activities

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<th>Activity</th>
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<tr>
<td>WestGrid Alberta HPC Equipment Launch</td>
<td>3-Apr-2012</td>
<td>WestGrid</td>
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<td>ACFAS booth for UdeM - CQ - CC</td>
<td>7-Apr-2012</td>
<td>Calcul Québec</td>
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<td>Intro to ACEnet</td>
<td>3-May-2012</td>
<td>Atlantic</td>
<td>7</td>
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<td>Intro to ACEnet</td>
<td>4-May-2012</td>
<td>Atlantic</td>
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<td>Computing Training Workshop 4Girls</td>
<td>10-May-2012</td>
<td>Calcul Québec</td>
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<td>24 heures des sciences UdeM (booth)</td>
<td>12-May-2012</td>
<td>Calcul Québec</td>
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<td>Science Rendezvous 2012</td>
<td>12-May-2012</td>
<td>Compute Ontario</td>
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<td>Compute Ontario Research Day</td>
<td>23-May-2012</td>
<td>Compute Ontario</td>
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<tr>
<td>Intro to ACEnet</td>
<td>6-Jun-2012</td>
<td>Atlantic</td>
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<tr>
<td>Calcul Canada et le calcul scientifique à UQTR</td>
<td>14-Jun-2012</td>
<td>Calcul Québec</td>
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<td>Intro to ACEnet</td>
<td>12-Jul-2012</td>
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<td>Intro to ACEnet</td>
<td>10-Sep-2012</td>
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<td>Intro to WestGrid &amp; Compute Canada - Patrick O'Leary</td>
<td>19-Sep-2012</td>
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<td>Présentation à la Faculté d'aménagement, d'architecture, d'art et de design et à la Faculté de Littérature</td>
<td>4-Oct-2012</td>
<td>Calcul Québec</td>
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<td>Visite avec des département de sciences humaines (design and architecture)</td>
<td>17-Oct-2012</td>
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<td>WestGrid Seminar - Falk Herwig - HPC Driving New Discoveries in Fluid Dynamics</td>
<td>7-Nov-2012</td>
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<td>Spring undergraduate open house</td>
<td>17-Nov-2012</td>
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<td>9-Jan-2013</td>
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<td>Intro to ACEnet</td>
<td>14-Jan-2013</td>
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<td>visite des groupe de recherche du CHUM - ANGUS</td>
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<td>Assenblé générale de CQ</td>
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<td>Guelph Technology Showcase</td>
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<td>rencontre direction de la recherche du CHUM</td>
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<td>Intrduction au Calcul Haute Performance au CRAD</td>
<td>20-Feb-2013</td>
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<td>WestGrid Seminar - Andriy Kovalenko - A Closer Look at HPC Behind Multiscale Theory &amp; Modeling</td>
<td>6-Mar-2013</td>
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<td>Fall undergraduate open house</td>
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<td>conférence pour étudiant du CEGEP - UdeM</td>
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<td>rencontre des chercheur de génomique de l'ICM</td>
<td>12-Mar-2013</td>
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<td>SATEC High-School Cluster Build and Parallel Programming</td>
<td>Jan-May 2013</td>
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## Training Activities

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<td>New User Seminar - offered weekly</td>
<td>Apr 2012 - Mar 2013</td>
<td>Compute Ontario</td>
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<td>2012 HPC Summer School (Ontario West) - 1 week</td>
<td>4-Jun-2012</td>
<td>Compute Ontario</td>
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<td>Courses: Introduction to High Performance Computing; Linux Command Line: A Primer MPI Programming; Programming GPUs with CUDA; HPC Best Practices; HPC Debugging</td>
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<td>Intro to Linux</td>
<td>1-Apr-2012</td>
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<td>Coast to Coast Seminar - Dr. David Hill (UofSydney)</td>
<td>4-Apr-2012</td>
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<td>Optimizing Tools for Development and Execution of Programs</td>
<td>4-Apr-2012</td>
<td>Compute Ontario</td>
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<td>SNUG Tech Talk</td>
<td>11-Apr-2012</td>
<td>Compute Ontario</td>
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<td>Intro to Shell Scripting</td>
<td>13-Apr-2012</td>
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<td>Intro to Grid Engine</td>
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<td>Parallel I/O Tutorial (HPCS 2012)</td>
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<td>Linux command line</td>
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<td>Grid Engine</td>
<td>15-May-2012</td>
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<td>Compilers and dev tools</td>
<td>18-May-2012</td>
<td>Atlantic</td>
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<td>Introduction to Visualization Workshop (SFU) - Brian Corrie</td>
<td>22-May-2012</td>
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<td>Shell scripting</td>
<td>22-May-2012</td>
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<td>Intro to Perl Scripting</td>
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<td>Intro to UNIX - 2 days</td>
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<td>High School Computer Science Day (UofM)</td>
<td>25-May-2012</td>
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<td>Python</td>
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<td>New trends in computational approaches for many-body systems, Summer School - 1 week</td>
<td>28-May-2012</td>
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<td>Graduate Program in Scientific Computing (credit course at Western)</td>
<td>May-July 2012</td>
<td>Compute Ontario</td>
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<tr>
<td>2012 Compute Ontario Summer Seminar Series Introduction to Compute Ontario and Compute Canada: The supercomputing facilities available and survey on numerical libraries Scientific computing using MATLAB and</td>
<td>May-July 2012</td>
<td>Compute Ontario</td>
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<td>Title</td>
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- Date: 28-Feb-2013
- Location: Calcul Québec
- Attendees: 19

### Introduction to OpenMP
- Date: 1-Mar-2013
- Location: Calcul Québec
- Attendees: 43

### Introduction à Linux pour le calcul scientifique
- Date: 5-Mar-2013
- Location: Calcul Québec
- Attendees: 12

### Introduction au calcul scientifique
- Date: 5-Mar-2013
- Location: Calcul Québec
- Attendees: 35

### Formation 2 jours : Le calcul de haute performance et programmation parallèle (OpenMP et MPI)
- Date: 12-Mar-2013
- Location: Calcul Québec
- Attendees: 25

### Intro to Compute Ontario
- Date: 13-Mar-2013
- Location: Compute Ontario
- Attendees: 5

### Sparse Matrices in MKL
- Date: 13-Mar-2013
- Location: Compute Ontario
- Attendees: 5

### C++
- Date: 20-Mar-2013
- Location: Compute Ontario
- Attendees: 4

### WestGrid Seminar - Doug Phillips - Using MATLAB on WG
- Date: 20-Mar-2013
- Location: WestGrid
- Attendees: 42

### Guillimin - Réunion des utilisateurs - Users Meeting
- Date: 21-Mar-2013
- Location: Calcul Québec
- Attendees: 8

### Introduction to ScaleMP
- Date: 22-Mar-2013
- Location: Calcul Québec
- Attendees: 18

### Linux pour le calcul de haute performance
- Date: 26-Mar-2013
- Location: Calcul Québec
- Attendees: 20

### Midi-conférence - Le nouveau standard C++ et le CHP
- Date: 28-Mar-2013
- Location: Calcul Québec
- Attendees: 24

### CES 731 Parallel computing: MPI (credit course at McMaster taught by Compute Ontario instructor)
- Date: Jan-Feb 2013
- Location: Compute Ontario
- Attendees: 2

### Scientific Computing: Part I
- Date: January 2013
- Location: Compute Ontario
- Attendees: 13

### Scientific Computing: Part II
- Date: March 2013
- Location: Compute Ontario
- Attendees: 13

### Outreach and Training Activities

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APPENDIX D: BOARD OF DIRECTORS

H E A (Eddy) Campbell
President, University of New Brunswick
A professor of mathematics, Dr. H E A (Eddy) Campbell holds two degrees from Memorial University of Newfoundland and a Ph.D. from the University of Toronto. He held a Natural Sciences and Engineering Research Council (NSERC) Postdoctoral Fellowship at the University of Western Ontario. Dr. Campbell’s main research interest is the invariant theory of finite groups and he continues to maintain an active research career. His NSERC Discovery Grant was renewed in 2008 for an additional five years. Dr. Campbell has served in a variety of capacities with NSERC and currently sits on the Executive Committee and the Committee on Research Integrity and is a member of its governing body. Appointed to a five-year term as the UNB President, Dr. Campbell led the university through the development of a strategic plan, building on UNB’s rich tradition of education, research and community service. Dr. Campbell has extensive experience in university administration, having served as President and Vice-Chancellor (Acting) and Vice-President (Academic) at Memorial University in St. John’s, Newfoundland. He also served as Associate Dean of the Faculty of Arts and Science and as Professor and Head of the Department of Mathematics and Statistics at Queen’s University in Kingston, Ontario. A past president of the Canadian Mathematical Society, Dr. Campbell is currently a member of the executive and investment committees of MPrime, a successor of the national centre of excellence known as the Mathematics of Information Technology and Complex Systems network (MITACS). These organizations develop programs to provide better links between universities and the communities they serve. In New Brunswick, he serves on the Boards of Future NB, Invest NB, the Atlantic Provinces Economic Council, the Huntsman Marine Science Centre and represents UNB on the New Brunswick Business Council, where he advocates for “Smart(er) NB”.

Siobhan Coady
President, Novocom Inc.
Siobhan Coady is a well-respected Newfoundland and Labrador business leader and President of Novocom Inc, a resource procurement company. From 2008 to 2011, she was the Liberal Member of Parliament for the riding of St. John’s South–Mount Pearl. She was Critic, Treasury Board; a member of the Industry Committee; and vice chair of the Operations Committee. Prior to entering politics, she owned and operated companies as diverse as Newfound Genomics Inc, a leading biotechnology company; The Clinical Trials Centre, a medical research company; and Bonaventure Fisheries, a privately-held fish harvesting company. Ms. Coady is a past chair (2003) and governor of the Canadian Chamber of Commerce. She was president of the St. John’s Board of Trade in 1993. She has been recognized as one of the Top 50 CEO’s in Atlantic Canada and has received the Queen’s Jubilee Medal. Ms. Coady is also a well-known political commentator for CBC. She currently sits on several private Boards of Directors as well as the Board of the Institute of Corporate Directors, St. John’s. She previously was on the Board of Genome Canada, the Public Policy Forum, The St. John’s Airport Authority, The Genesis Centre, the Atlantic
Innovation Council and the Institute of Chartered Accountants Newfoundland, to name a few. Ms. Coady is an alumnus of Memorial University of Newfoundland and Labrador, Oxford University and the University of Toronto. She is an accredited director (ICD.D) of the Institute of Corporate Directors and an Accredited Public Relations Professional (APR).

Mark Dietrich  
**CEO, Ontario Society of Professional Engineers**  
Mark Dietrich is the Chief Executive Officer of the Ontario Society of Professional Engineers (OSPE). An entrepreneurial leader with 20 years of executive management experience, Mark has a proven track record of building and transforming organizations, increasing revenues, and maximizing organizational effectiveness. He specializes in innovative corporate strategy, marketing, business development and exceptional service delivery. Prior to joining the OSPE, Mark founded Bloodstone Solutions Inc., a Toronto-based professional services firm that specialized in strategic value innovation, lean services, and eGovernment solutions for public and private sector clients.  
Mark was also the Executive VP & COO for the Ontario Research and Development Challenge Fund (ORDCF), a $500 million government fund established to support leading-edge, innovative and industrially relevant university and hospital research. The ORDCF provided support to more than 100+ university-industry research partnerships in diverse areas, including nanotechnology, IT, and bioinformatics. His diverse background in new product development, commercialization, service delivery, and marketing was built through more than a decade of executive leadership roles with companies in the Greater New York City area.  
His success stretches across multiple industries, including consulting (strategy, marketing, process improvement, business model innovation), technology and information services (internet service delivery, commercialization, engineered solutions), and finance (project- and asset-based financing), in the United States and Canada, with international mandates. Mark has a degree in Electrical Engineering from Vanderbilt University in Nashville, Tennessee.

Roger Foxall  
**CEO, Life Science Strategies Inc.**  
Roger Foxall obtained his B.Sc.(Eng.) in Physical Metallurgy at the Imperial College of Science and Technology, University of London. He obtained his Ph.D. in Physics at the Cavendish Laboratory of the University of Cambridge, followed by postdoctoral studies at the University of Oxford. He moved to Ottawa in 1968 to take up a Research Officer position at the National Research Council. In 1975, he began a series of assignments that prepared him for a career in research management, including a secondment to the Treasury Board Secretariat as Program Analyst.  
In 1984, he became Director of the NRC Atlantic Research Laboratory in Halifax, later renamed the Institute for Marine Biosciences, and he was Director General from 1990 until April 1998. Other roles that Roger played during his time in Halifax included membership of the Council on Applied Science and Technology (advisory to the Premier of Nova Scotia); the Steering Committee for the Aquatic Biotechnology Network – AQUATECH; the Board of Directors of the Nova Scotia Oceans Initiative; the Board of the Canadian Centre for Fisheries Innovation; the Editorial Board of the Journal of Marine Biotechnology; and the
International Advisory Board of the Marine Biotechnology Institute of Japan.
Roger moved to British Columbia in July 1998, and established a consulting company
focused on the life sciences, based on his experience in genomics and marine
biotechnology, including experience in forming linkages with Canadian companies and with
other institutions throughout Canada, the Americas, Europe and the Asia-Pacific region.
From August 2000 through January 2002, he served as the founding President and CEO of
Genome British Columbia – one of six centres across the country funded in part by Genome
Canada. He then served as Executive Vice President Research until December 2003 and
Executive Vice President Corporate Development until August 2005. Roger now specializes
in strategic analysis and advice regarding the genome sciences, other areas of the life
sciences, as well as governance and management of large-scale science and technology
initiatives.

Donald Hathaway
Managing Director, Governance DNA
Don Hathaway has demonstrated his abilities in diverse corporate settings as a CEO in
business, a senior partner with international consultancies and a corporate director. His
forty-year business career has included major undertakings with government and
academia, with over half at senior executive levels, accumulating expertise in strategy,
finance, risk management, marketing and corporate governance. He has held some 35
board, committee and board chair roles, putting him at ease on public, private and NFP
boards. As an engineer and a serial entrepreneur he is often on the board of small or
emerging companies and he has direct experience in high profile roles with public-private
partnerships. Further, he has worked with the boards of many of Canada’s largest
corporations on governance, financial and risk issues. He has strong competencies in board
operations, the board-management interface and board committee work, particularly audit,
risk, compensation and governance. He has direct experience with corporate re-
structuring, mergers and acquisitions, regulatory compliance and initial public offerings.
He has written two books on corporate governance, published in 2008 and 2010, and he
appears frequently as a speaker or panelist on governance, risk and financial issues.
Currently, he is a director of three technology-based companies and a member of the
Independent Review Committee for group of mutual funds. As well, he is the Chair of the
Advisory Panel on Governance and Management for Compute Canada, the national
organization for high performance computing supporting research nationally. He is a Vice
Chair of the Ontario Chapter of the Institute of Corporate Directors. He is an advisor to the
Canadian Board Diversity Council, and had a leading role in designing the curriculum of its
‘Get On Board’ governance program. He is a former member of the Dean’s Advisory Council
of the School of Business and Economics at Wilfred Laurier University. He is a Past
President and a Fellow of the Institute of Management Consultants of Ontario, a Past
President of the Institute of Management Consultants of Canada, a former Governor of York
University, a former Chairman of the University of Waterloo Advisory Council, a former
member of the Canadian Employment and Immigration Advisory Council, and a former
member of the Advisory Council to the Masters in Business, Entrepreneurship and
Technology (MBET) at the University of Waterloo.
He is a member of the Institute of Corporate Directors and holds its ICD.D designation. He
studied electrical engineering and then mathematics at Sir George Williams University.
(now Concordia), and then took an MBA from York University. He has subsequently taken an ongoing stream of specialist studies, including the executive program in economic value analysis (EVA) at the Kellogg School at North-western University and extensive work in risk management.

John Hepburn  
**Vice-President (Research & International), University of British Columbia**

John Hepburn was born in Hamilton, Ontario, and completed his undergraduate studies at the University of Waterloo, graduating in 1976 with his BSc. He continued his education at the University of Toronto and obtained his PhD in 1980. Following two years as a NATO Postdoctoral Fellow at the Lawrence Berkeley National Laboratory, he began his academic career back at the University of Waterloo, where he was appointed an Assistant Professor of Chemistry and Physics in 1982, and ultimately Chair of Chemistry in 1998. In 2001, he moved to the University of British Columbia as a Professor of Chemistry and Physics & Astronomy, and Head of Chemistry. He became Dean of Science in 2003, and Vice President Research in 2005. The international portfolio was added to John’s list of responsibilities in August 2009. He has been a Fellow of the A.P. Sloan Foundation, a Foreign Research Fellow of the CNRS (France), and a Canada Council Killam Fellow. He has been awarded the Rutherford Medal and the Noranda Prize and is a Fellow of the Royal Society of Canada, the American Physical Society, and the Canadian Institute for Chemistry. He is internationally renowned for his research in laser spectroscopy and laser chemistry, and is currently carrying out research in surface science, laser spectroscopy, and quantum control of atoms and molecules. In addition to his work at UBC, John Hepburn currently serves on a number of boards. He is also a member of the Scientific Advisory Committee for the Council of Canadian Academies.

Fassi Kafyeke  
**Director of Strategic Technologies, Bombardier**

Since joining Bombardier Aerospace in 1982, Fassi Kafyeke has had a distinguished career with the organization and has progressively attained positions of increased responsibility. Currently, as the Director of Strategic Technology, Dr. Kafyeke is responsible for all engineering research and development, external relations and Design for Environment at Bombardier Aerospace. In 1980, Dr. Kafyeke graduated as an electromechanical engineer (aerospace) from Belgium’s University of Liège. The following year he completed his Master’s degree in Air Transport Engineering (Aircraft Operations and Maintenance) at the Cranfield Institute of Technology, England. In 1994, he received his Doctorate in mechanical engineering (Aerodynamics) from École Polytechnique de Montréal, in Canada. From 1981 to 1982, Dr. Kafyeke worked at the Von Karman Institute for Fluid Dynamics, Belgium as a research officer. At the start of his career with Bombardier Aerospace, in 1982, Dr. Kafyeke worked to develop various Computational Fluid Dynamics (CFD) methods for Aerodynamic analysis. He then moved to designing airfoils and wings and then to conducting wind tunnel testing to validate aerodynamic designs. In 1992, he was appointed section chief of Advanced Aerodynamics, Manager in 1996 and elevated to Senior Engineering Advisor in 2004. Since 1996, he was the Chief Aerodynamicist in charge of aircraft aerodynamic design and development and for all development wind-tunnel testing for several Bombardier aircraft, including the Global Express, CRJ700/900/1000
NextGen, Challenger 300 and CSeries aircraft. In 2006, strategic technology was added to his mandate and, in 2007 he became Group Director of Strategic Technology, in charge of the company research and development efforts.

Dr. Kafyeke is a co-author of the book “Computational Fluid Dynamics for Engineers: From Panel to Navier Stokes Methods With Computer Programs”, published by Springer-Verlag in June 2005. In addition, he has published various aerodynamics lecture notes and papers for various associations, including CASI, AIAA, ASME, SAE and AGARD, as well as Bombardier internal reports on aircraft development and testing. In addition, Dr. Kafyeke is actively involved in various groups dedicated to the advancement of aviation and technology. In 2008, he was named Co-chair of the Canadian Aviation Environment Technology Road Map (CAETRM). He is a founding Member of the Board of GARDN (Green Aviation Research and Development Network) since 2009; he was also a Member of the Board of FQRNT (Fonds Québécois pour la Recherche en Nature et Technologie) until 2011 and he is now the Chairman of the Board of the “Regroupement pour le développement de l’avion plus écologique”, a consortium of Québec aerospace industries promoting the development of green aircraft technologies. He is a Fellow of the CASI (Canadian Aeronautics and Space Institute); an Associate Fellow of AIAA (American Institute of Aeronautics and Astronautics); and a Member of RaeS (Royal Aeronautical Society, United Kingdom).

He was the President of the Canadian Aeronautics and Space Institute from 2002 to 2003. In 2001, he was recognized for his work by the Ordre des ingénieurs du Québec (Quebec Order of Engineers) and received the prestigious Grand Prix d’excellence for the year. In October 2009, he received the “Prix Innovation” from the Association of Graduates from École Polytechnique de Montréal.

Nils Petersen
Professor, University of Alberta

Nils Petersen, PhD (California Institute of Technology) is a Professor of Chemistry at the University of Alberta. He is the NINT Fellow and an Honorary Professor of Nanoscale Biological Sciences, University of Twente. Dr. Petersen’s current research focuses on intermolecular interactions in biological membranes, particularly the study of dynamics and distribution of molecules within the membrane as a means of understanding cell-cell communication, signal transduction, adhesion, and locomotion of cells. His work spans a range of disciplines from computation to biology and has led to 130 publications to date. After research positions at Cornell University and Washington University Medical School, he returned to The University of Western Ontario’s Department of Chemistry as a faculty member in 1981. While at Western he was Associate Dean of Graduate Studies (1993-95), Chair of the Department of Chemistry (1995-99), and the first Associate Vice- President (Research) at Western (1999-2000). After nearly three years as Vice- President (Research) at Western, he joined the NRC in 2004 as Director General for the National Institute for Nanotechnology with a concurrent position as Professor of Chemistry at the University of Alberta. In 2011, he retired from the NRC and subsequently served one year as Acting Associate Dean (Research) in the Faculty of Science at U of A. Dr. Petersen has served on twelve non-for profit Boards for both incorporated and non-incorporated entities. Among the former he was the Chair of the Board of the UWO Research Park, a member of CLLRNet (an NCE) and CMC Microsystems, and he currently
serves as a member of the Boards of the Canadian Light Source, ArboraNano (a Business-led NCE); and PIMS. He was the founding Board Chair for SHARCNet (Shared Hierarchical Academic Research Computing Network), a network of high-performance Beowulf computer clusters in South-western Ontario. Other Advisory Board memberships include the CIHR Institute for Genetics International Advisory Board, the California Nano Systems Institute, and the Canadian Institute for Synchrotron Radiation. He currently Chairs the Board of BiopSys, an NSERC Strategic Network at the University of Toronto.

Janet Rossant
Chief of Research, The Hospital for Sick Children
Dr. Janet Rossant is a Senior Scientist in the Developmental & Stem Cell Biology Program and Chief of Research at The Hospital for Sick Children, Toronto. She is also a University Professor, University of Toronto, and Professor in the Departments of Molecular Genetics, Obstetrics/Gynaecology and Paediatrics, University of Toronto. Her research interests centre on understanding the genetic control of normal and abnormal development in the early mouse embryo using both cellular and genetic manipulation techniques. Her interests in the early embryo have led to the discovery of a novel placental stem cell type, the trophoblast stem cell. She is Deputy Scientific Director of the Canadian Stem Cell Network and directs the Centre for Modelling Human Disease in Toronto, which is undertaking genome-wide mutagenesis in mice to develop new mouse models of human disease.

Dr. Rossant trained at the Universities of Oxford and Cambridge, United Kingdom and has been in Canada since 1977, first at Brock University and then at the Samuel Lunenfeld Research Institute, Mount Sinai Hospital, Toronto, from 1985 to 2005. She is a Fellow of both the Royal Societies of London and Canada and a Distinguished Investigator of the Canadian Institutes of Health Research. In 2007, Dr. Rossant was awarded the March of Dimes Prize in Developmental Biology and the Conklin Medal from the Society for Developmental Biology. In 2008, Dr. Rossant was elected as a Foreign Associate to the National Academy of Science. Dr. Rossant is actively involved in the international developmental biology community. She was an editor of the journal Development for many years and was President of the Society for Developmental Biology in 1996/97. Rossant has also been involved in public issues related to developmental biology, most recently serving as Chair of the Canadian Institutes of Health Research working group on stem cell research and as a member of the National Academies Stem Cell Guidelines Panel.

David Sénéchal
Professor, Université de Sherbrooke
David Sénéchal is a theoretical physicist and professor of Physics at the Université de Sherbrooke. He obtained a BSc (Honours Physics) from McGill University in 1985, and a PhD in theoretical Physics from Cornell University in 1990. After 2 years as NSERC postdoctoral fellow at Laval University, he joined the Faculty at Université de Sherbrooke in 1992, where he has been ever since. He is the co-author of a well-known book on Conformal Field Theory (Springer, 1997).

Since about 1999, the focus of his research has been on novel computational method applied to strongly correlated materials, such as high-temperature superconductors. He has been the faculty responsible for high-performance computing at the Université de
Sherbrooke from 2001 to 2011, Scientific director of RQCHP (A Québec HPC consortium of 5 universities) from 2006 to 2011, and a lead researcher in Compute Canada between 2006 and 2011. In particular, he has chaired the main operational committee of Compute Canada from 2006 to 2009 and successfully defended the Compute Canada proposals to CFI in 2006 (the National Platform fund) and 2011 (Major Science Initiative fund). He now chairs the Physics Department at Université de Sherbrooke.

John Towns
Principal Investigator and Project Director, XSEDE

John Towns is the Director of the Collaborative Cyberinfrastructure Program Office at NCSA. He is also the PI and Project Director for XSEDE (Extreme Science and Engineering Discovery Environment), the NSF’s premier cyber infrastructure, and leads other projects at NCSA. He has gained a broad view of the needs of computational and data-intensive science and engineering researchers through his key roles in policy and program development and implementation as part of several large-scale NSF projects as well as his involvement in key activities at the University of Illinois where he currently serves on the Research Committee of the IT Executive Governance Committee.

His background is in computational astrophysics making use of a variety of computational architectures with a focus on application performance analysis. At NCSA, he provides leadership and direction in the support of an array of computational science and engineering research projects making use of advanced computing and data resources. He plays significant roles in the deployment and operation of computational, data, and visualization resources, and Grid-related projects that embody the deployment of technologies and services to support the establishment of a distributed computing infrastructure.