

EXECUTIVE SUMMARY

Context for this Document

The Canadian Light Source (CLS) is Canada's national synchrotron light facility located on the campus of the University of Saskatchewan, in Saskatoon. It is a powerful source of synchrotron light, primarily for the use of Canadian academic and industrial researchers from a broad range of unique scientific disciplines. Canadian Light Source Inc. (CLSI) operates the facility as a separate, non-profit company, wholly owned by the University of Saskatchewan (U of S).

This document sets out a Strategic Plan for the CLS that covers all aspects of the facility. It covers the four-year period ending March 2013. This plan is of crucial importance for the CLS as it will guide the facility through the transition period from building and commissioning a world-class synchrotron light facility to establishing an excellent user facility with the technical, scientific and personnel support that is required to build and maintain a strong and successful synchrotron research community. This plan is also the basis for the scientific future of the CLS. In order to remain competitive with other third generation synchrotron light facilities worldwide, continuous efforts are required to keep each beamline and each experimental station at the state-of-the-art while being open to new developments. This requires a careful assignment of available resources, as determined by the CLS operational budget, and demands the vision and determination to recognize new developments, reaching for emerging opportunities and pursuing new avenues for funding groundbreaking projects.

A Brief Overview of the CLS

CLS is a third generation synchrotron light facility. These facilities are characterized by the quality of the electron beam and by the fact that most experiments use an array of alternating magnets (known as insertion devices) as sources for the light used. While the CLS has a smaller circumference than other third generation, medium-energy synchrotron light sources, it is in many aspects (e.g. maximum current, beam stability, lifetime of the beam) comparable to and in many cases better than, other facilities. The CLS was not optimized for a specific energy range (e.g. the vacuum ultraviolet/soft X-ray range or the hard X-ray range), nor for any specific application (e.g. microfabrication or imaging). This has proven to be a characteristic advantage for the CLS and it has made it possible to build world-leading beamlines for various energy ranges and for various applications. Like most other synchrotron light facilities, CLS is a user facility--the majority of research done at the facility is performed by researchers from other institutions and companies. Beamlines and experimental stations are built based on proposals from users groups from the scientific community based on a rigorous selection process. These researchers become the nucleus of the beamline's users and are charged with encouraging its use by other researchers from academia, government and industry. To date, the Canada Foundation for Innovation (CFI) has funded all but two of the beamlines.

The 21 beamlines that will be available at the CLS when this plan comes to its end in 2013, cover the spectral range from the infrared to the hard X-rays, and make available most of the techniques that are in high demand by the international synchrotron user community. However, there are some areas where it is already clear that the demand from users (and, at least in one case, from industrial users) exceeds the existing capabilities. There are also emerging areas in synchrotron light-based research which cannot be exploited with existing beamlines, for example, experiments based on the coherence properties of synchrotron light, including lens-less imaging or photon experiments in which lasers and photons are jointly used to probe matter. The CLS will work with the user community and industrial clients to identify opportunities to develop beamlines utilizing these new capabilities as they evolve, ensuring that Canada's synchrotron remains competitive with other third generation synchrotron facilities worldwide.

CLS has more than 700 registered users. This number will grow with the increasing number of operational beamlines. Users often visit the facility more than once in a year, culminating in over 2,400 user visits to date. As the number of beamlines increases to its presently planned and funded level of 21, it is estimated that the annual number of individual researchers accessing the facility will be around 1000, reaching approximately 2000 visits annually by 2012.

Currently, scientists from nine provinces and ten countries have performed experiments at the CLS. The scientific output, as measured by the number of peer-reviewed publications per beamline, is on par with that of established facilities, and the quality of published research is excellent. Utilization of the CLS continues to grow as more and more research stations achieve full operational status. The broad range of new capabilities that will be provided by the 14 beamlines of Phase II and III will lead to the attraction of additional users from a number of diverse scientific backgrounds. As with other synchrotron facilities, the majority of CLS users currently come mainly from physics and chemistry, the two disciplines that have traditionally utilized synchrotron techniques. However, users from the life sciences (including biology, pharmacy, and medicine) are the fastest growing sector. Strengthening this development is a major objective for CLS over the next few years. The CLS will also work to attract other 'non-traditional' users such as archaeologists, palaeontologists and museum curators and conservators. For these groups, synchrotron light offers a completely new set of research capabilities, but it will take special efforts and resource commitments (both financial and personnel) to attract these new users.

A key component of the strategic mission of the CLS is to engage the industrial community to the highest degree possible. The CLS, as Canada's state-of-the-art synchrotron facility, provides unique capabilities to industry in a broad range of applicable technologies. The CLS is already a science and technology success story in providing an entrepreneurial advantage to Canadian industries that use synchrotron science to solve real business problems. From the earliest conceptualization of the CLS, industrial participation through collaboration and outreach has been a central consideration. In addition, CLS has chosen to focus this mandate in a group of highly qualified scientists. The CLS Industrial Group currently employs eight scientific personnel whose key focus areas are Earth and Environmental Science, Materials Science, and Pharmaceuticals and Life Science. Most synchrotrons around the world have created

industrial programs, but the CLS was the first to build such programs into its core organizational structure from the outset of the project. Since then, other new facilities in Australia, France, and the UK, for example, have followed the CLS model.

The CLS has established aggressive targets for participation of industry through a fee-access structure. At the beginning of each six-month scheduling cycle for use of the facility, 25% of the time available on each beamline is set aside for fee-access. Unused time reverts to the broader peer-reviewed community. This guaranteed first come, first served access, coupled with a very simple and straightforward intellectual property policy, is highly attractive to industry. Industrial research and applied research of industrial relevance comprises a broad range of projects, from one-time experiments that help solve an urgent problem on a production line, to long-term projects which help companies develop new techniques or products, and to measurements that satisfy regulatory requirements. The value of all these projects for the Canadian economy goes significantly beyond the monetary value of the service that CLS provides, as in many cases the results are the basis for either creating new jobs or securing jobs by ensuring a company's continued success. The industrial use of the CLS also goes beyond the service that the Industrial Science Group provides for companies, as a significant number of our academic users also collaborate with industrial partners.

In October 2009 the Canadian Light Source celebrated the fifth anniversary of its official opening on October 22, 2004. The CLS is currently in a crucial phase of transition: the first years of operation were dominated by goals to optimize all machine parameters and to establish routine operations. These goals have been achieved; the CLS delivers about 5000 hours of operation per year and with reliability higher than 96% (defined as the ratio of beam time delivered without system trips or faults to total time scheduled), making the CLS comparable (and in some cases better) than other third generation facilities. The coming years will be defined by the challenges of establishing the CLS both as a world-class user facility with more than 20 operational beamlines and a valuable partner for industry. During this time, there will be a strong focus on further optimizing beamlines and attracting more users by providing additional support, not merely by carrying out experiments, but also in the preparation of beam time proposals and in the handling and interpretation of data collected at the CLS.

Six Strategic Goals

Starting points for the development of the strategic goals of this plan were:

- The Vision statement (*To be a global leader and a recognized centre of excellence in synchrotron science and its applications*) and Mission statements for the CLS as approved by the Board of Directors in June 2006;
- The core values that guide the operation of the CLS;
- CLS' role in the national and international synchrotron light user community;
- Canada's Science and Technology Strategy, *Advantage Canada*; and
- A basic SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, conducted in June 2005 by CLS management.

Six strategic goals were developed based on these guidelines. These goals are not completely independent as some provide the basis to achieve others. However, compared to other synchrotron facilities in the world or other large scale Canadian research facilities--such as TRIUMF--CLS is still a young facility. It is undergoing a transition from being a construction project to a user facility, and from obtaining major capital funding to securing an adequate operating budget, while also striving to gain recognition as a national facility. For this reason, Goals 3 and 5 discussed below are currently viewed as standalone goals that will be achieved in the next few years. It is anticipated that they will become standard operating procedures and business processes in subsequent plans.

Objectives were defined for each of the six goals, with action items, milestones and deliverables formulated to achieve them. Action items are divided into two categories: those for which the required financing is secured in the CLS operational budget and those for which additional funding and funding sources have yet to be found. The action items of this second type are marked with an asterisk (*). For each goal, a budget has been developed (including capital expenses and operational funds), along with a human resources plan, including projections of salaries and employee benefits.

The action items with their starting dates, their anticipated completion dates, and with staff identified as being responsible for ensuring the delivery of the various deliverables, are summarized in a deliverables and milestones matrix that is attached in Appendix A of this plan. Projected Operating Expenditures, by goal, are outlined in Appendix B. As this is the first comprehensive strategic plan for this facility, a strong focus is placed on those action items deemed to be achievable by the end of the first full year of this plan in March 2011, with a greater corresponding amount of detail placed on milestones slated for completion at that time. As neither the needs of users and customers, nor the future development of new applications and techniques of synchrotron light are completely predictable, this plan is a living document that will have objectives and supporting action items updated regularly on an annual basis throughout the funding cycle. The plan's implementation and progress will be reviewed quarterly with some adjustments and modifications of deliverables anticipated.

The six goals of this strategic plan are:

Goal 1: Be a global centre of excellence in synchrotron-enabled research and innovation.

The Canadian Light Source is at the leading edge of third generation medium energy synchrotrons. All beamlines have been designed to be internationally competitive, while being optimized to the CLS machine parameters.

CLS management is well aware that "global leadership" in synchrotron light-based research and "world leading research and development" as stated in the vision statement cannot be achieved in all areas and for all techniques. However, it will always be the goal of CLS over the coming years to have at least two beamlines that are world leading in their corresponding research area--without ignoring the requirements of the other beamlines. "Global leadership" in some areas is crucial for the standing of the CLS within the international synchrotron research community and to attract world-class

scientists who will always use the best facilities available for their research. CLS already has at least two beamlines that are world-leading: the Phase I X-ray Spectromicroscopy beamline and the Phase II Biomedical Imaging and Therapy (BMIT) facility. Thus, it will be an objective within Goal 1 to support these beamlines so that they remain world-class.

In order to remain competitive internationally, the CLS cannot remain static. Minor improvements must be made continually within the scope of individual beamline operating budgets. More significant improvements are planned for some of the beamlines within the scope of our capital budget. Phase I beamlines will prepare for the next round of the CFI Leading Edge Fund (LEF) competition. Beamlines that will likely submit upgrade proposals are Spectromicroscopy and the Canadian Macromolecular Crystallography Facility, with endstation enhancements the most likely priority. Other eligible beamlines include Hard X-ray Microanalysis, Far Infrared and Mid Infrared facilities. These upgrades will not add significantly to the operational cost of the CLS. The main difficulty with these proposals will be the availability of matching funds, an inherent difficulty with all CFI proposals.

To be a great user facility, the CLS must be able to recruit and retain the best scientific staff. However, the CLS is more than just a user facility. Our partners value both our unique facilities and the expertise of our people. As a national facility, we have the opportunity to be leaders, taking on grand scientific challenges of great importance to society. To achieve this, we need to devote a fraction of its resources to an in-house research program. Such a program was started in 2009 with five projects and this program will be strengthened in the coming years.

Over the last five years, CLS has been the recipient of tremendous support from universities, as well as from national and provincial laboratories from across Canada, with the provision of in-kind contributions of scientific expertise for the design of experimental facilities. Several scientists from other institutions have also contributed by building and making available various critical pieces of analytical equipment at CLS. These experts work with the CLS user community to ensure the safe operation and advancement of research utilizing this equipment. These collaborations, crucial for the success of the CLS, will be strengthened. CLS will also strive to involve more universities and provinces in future developments.

Goal 2: Make the CLS the most responsive and valuable synchrotron light facility for industry.

All major light source facilities in the world recognize the importance and the potential of industrial utilization and have implemented some form of industrial program. Since its inception, the CLS has recognized the need to utilize synchrotron light-based research to support Canada's industrial and economic interests. The program that was implemented at Canada's synchrotron facility is by far the most ambitious and most appropriate for industrial needs. CLS is the only facility in the world with the goal of achieving 25% utilization of its facilities by industry in terms of research time. To accomplish this, CLS has a dedicated group of scientists to work for, and in collaboration with, industry. At the beginning of each six-month operational cycle, 25% of the available time on each beamline is set aside for industrial research. Time that is not used for the industrial

program reverts to the broader peer-reviewed community. For some beamlines the allocated industrial beamtime of 25% is fully subscribed, while this allotment is not fully utilized at other beamlines because their techniques are not in high demand by industry.

The financial projections within this strategic business plan are based on very aggressive goals for industrial utilization. These goals have not yet been adjusted to reflect the global economic slowdown. As part of our future planning, the Business Development Subcommittee of the Board of Directors will regularly monitor industrial utilization and review and adjust these goals and the associated financial projections on the basis of the actual numbers. CLS is well aware of the intrinsic risk of this approach and is prepared to adjust projected expenditures in order to stay within the available operational budget without any additional requests to Industry Canada.

In order to achieve its industrial science targets, it is essential that awareness regarding the importance of being responsive to industrial clients permeates the CLS culture. There is already an overall understanding of the significance of the industrial science mandate as part of the CLS Mission, but progress needs to be made to both improve processes to facilitate industrial science as well as to engage staff.

The CLS has one of the most successful industrial programs of any synchrotron. We are planning to expand industry-relevant scientific capabilities and research, covering the industry value chain from discovery (fundamental) to commercial (revenue generating) science. This will increase the visibility of the CLS as an industrial service and solution provider. We will also try to encourage collaborations between CLS staff, government laboratories, industry and academic communities in order to increase CLS expertise within various scientific areas.

Goal 3: Maximize the performance and availability of the facility.

To remain competitive with other synchrotron light sources world-wide and to establish a world-class user facility, the CLS facilities must operate 24/7 for a significant fraction of each year. This requires reliable equipment and good maintenance procedures to ensure that all major equipment operates as intended, when needed. CLS has set the goal of 5000 hours of user operation per year (typical of other mature synchrotron facilities) with up to an additional 1000 hours of operation for developing, commissioning and improving the accelerator systems. This goal was achieved in 2008, but it is essential to continue to meet this goal in subsequent years. This level of operation leaves approximately 12 weeks of the year for major equipment maintenance, installation of new facilities, and shut-downs.

Experience over the first five years of operation has highlighted several areas where work needs to be done to improve the reliability of accelerator system components. Although they have not generally had a major impact on user operation, they remain a concern for reliable, consistent operation of the facility. The primary concern is old equipment from the Saskatchewan Accelerator Laboratory that was incorporated into the CLS facility. Some of this equipment is over 40 years old with spare parts no longer available from any source. In other cases, the performance of the equipment has been shown to be inadequate for CLS applications (e.g. insufficient stability in power supplies). CLS technical staff has reviewed the suitability of all the old equipment, and

started a replacement program to ensure good on-going performance and reliability from all accelerator systems. Most of the planned changes are essential for moving to “top-up” operation (continually injecting electrons into the storage ring), which requires a much more stable and reliable injector system.

Several projects are already in progress for improving beam stability. There are two main approaches: eliminate the causes of instability, and provide feedback systems to increase beam stability. There are also two main beam feedback systems that are used for improving orbit stability: the global orbit feedback system and the transverse feedback system.

CLS currently operates with a maximum injected current of ~ 250 mA, although the storage ring (with the exception of the installed radio-frequency power) was designed for 500 mA. There are two main strategies for achieving significantly higher average current: more frequent injections to compensate for the beam current decay and operating at a higher initial current. Increasing the average current by more frequent injections (“top-up” is simply injection once every minute or two to keep the beam current constant to within 1% or less) requires the ability to inject while keeping all the beamline shutters open. This mode of operation, which is the preferred one for most users, is currently not permitted under the CLS operating license. Top-up operation also can result in significant improvements in the long-term beam stability as thermal drifts are reduced substantially when the beam current is essentially constant.

The CLS horizontal beam emittance (the ‘size’ and ‘spread’ of the beam) is substantially higher than all other recent 3 GeV light sources (~ 18 nm compared to 0.8 – 4 nm), primarily because of the small size of the storage ring. As a consequence, the beam size is approximately twice as large as that in other sources leading to potentially lower X-ray flux density and brightness. Some reduction in the horizontal emittance may improve the performance of some CLS beamlines. During the original design, an alternate operating point was analysed that had significantly lower emittance (~ 13.5 nm), which may be a better operating point for most beamlines. Even if the storage ring can be operated at this point, additional work is needed to demonstrate the improvement (or non-deleterious effects) on each beamline. A more significant decrease in the horizontal emittance might be possible with major changes to the storage ring lattice (such as changes to the storage ring magnets) which will probably require major changes in design and/or magnet technology. Possible alternatives will be evaluated over the longer term, along with the potential associated improvement to the beamlines' performance.

The CLS facility consists of a mixture of new equipment from recent beamline projects, moderate-aged equipment from our Phase I construction, and aging equipment inherited from the Saskatchewan Accelerator Laboratory. The CLS is no longer in the favorable situation of having the bulk of its systems new and expected to operate relatively worry free. Maintaining the same level of performance requires continued effort and a balance between cost, risks and production. Establishing a balance between these competing factors requires focused data collection and monitoring to allow a meaningful evaluation of the condition of the key components and systems which leads to an informed risk assessment of those systems and sets priorities for maintaining operations.

Goal 4: Plan for CLS' scientific future.

Planning for our scientific future involves careful consideration of a number of areas:

- existing infrastructure;
- capacity for new infrastructure;
- the user community (both existing and potentials for growth);
- the current and anticipated future direction of science;
- the vision and mission of the CLS; and
- our desire for (and capability of) innovation.

As the CLS matures into an operational facility that is almost fully developed, it is clear that additional support infrastructure is necessary to optimally leverage the investment in advanced scientific instrumentation. This infrastructure includes expansion of the experimental hall to support the development of the last straight section and two of the remaining bend magnet ports, additional office space and meeting rooms for staff and visiting researchers, and improved amenities for users.

With completion of the Phase III development, the CLS will have 23 beamlines operating. The CLS has one undeveloped straight section and four bending magnet ports. Based on current best practice, the straight section could support one proposal with two or three closely related facilities, and the four bending magnet ports could provide light to one facility each. Thus, if all possible photon source points are fully developed, the CLS has capacity for up to 28 to 30 experimental facilities. Typically, in the life cycle of experimental facilities, the time from initial concept to funded proposal has been somewhere between three and five years, followed by a construction period of two to three years. Thus, some of the available expansion ports could potentially source operating experimental facilities in the 2016 timeframe. The CLS intends to continue to support and develop scientific excellence in the Canadian and international research communities by embarking on a process to identify how best to use these photon ports, with an initial focus on developing the last straight section. The target for this initial program is to have a funded proposal in 2013, with the facility operational in 2016. Developing a successful experimental facility requires the identification of a significant research opportunity, the development of a community in support of a proposal, and the development of the proposal itself. The most promising target communities for the last remaining straight section include environmental, earth sciences and life sciences. Workshops will be held in each of these areas in 2010. Outcomes of these workshops will help to form the selection of a science program to develop a full proposal in 2011.

The CLS functions primarily as a user support facility. While many facilities are already at an optimal usage level, as new facilities become operational, and to stay current with and relevant to the research aims of the larger community, systematic development of our research community, both applied and academic, is crucial. To achieve optimal usage of the full facility, with the best and most productive science outcomes, CLS plans to work towards a doubling of its user community over the next three to five years. One additional principle investigator typically increases the pool of users by three to five people. Thus, adding one principle investigator per operating beamline next year would translate to about 40 new users. As a stretch target, CLS is proposing to attempt to

annually attract one new international principle investigator and two new Canadian principle investigators per operating beamline in the next three to five years. In order to grow the community appropriately, CLS is developing a formal team of mentors consisting of senior CLS staff and high profile CLS users. One or more members of this team will visit strategically targeted institutions and individual researchers.

Current directions in material science make advanced laser capability an almost indispensable tool. For example, the ability to laser align molecules within a sample to enhance polarization effects enables a range of new science capabilities that would be applicable to a number of existing experimental facilities. In addition, laser-based pump probe experiments and time slicing experiments would represent a significant enhancement to the range of science the CLS could investigate. The femtosecond laser community in Canada has already shown a real interest in developing programs at the CLS.

Goal 5: Ensure the long-term sustainability of the CLS as a national facility.

The CLS must be responsive and accountable to a number of constituencies in order to ensure its long-term viability and sustainability. These include:

- Industry: to encourage collaborative research using the CLS that leads to the commercialization of knowledge in support of Canada's economy;
- Government at the Federal and Provincial levels: to provide on-going funding support and meet regulatory requirements;
- Academia: as Canada's national synchrotron research facility, CLS must foster the support of Canada's academic institutions and encourage its use by their researchers;
- The international scientific community: to demonstrate that research conducted at the CLS is world-class;
- Public:
 - Provide a foundation for broad political support and foster a sense of ownership in Canada's synchrotron;
 - Increase awareness of the impacts of synchrotron science on the economy and everyday life;
 - Encourage youth to pursue scientific careers and contribute to the development of next generation of highly qualified people; and
 - Foster science literacy.

Positive engagement with all levels of government and industrial entities, as customers as well as investors, is essential to the continued growth and successful operation of CLS. Three major corporations, Boehringer Ingelheim, Rockwell Collins Canada and SaskPower, have invested in CLS infrastructure. Continued successful investment outcomes depend upon a long-term effort to effectively convey the valuable impact that science produced by CLS and its users has, and will continue to have, on Canadian society. In addition, developing effective processes to track the societal and economic impact of CLS research will add to the effectiveness of these communications.

The effective and coordinated use of communications, public relations and marketing activities and products, in a variety of media and to a variety of

audiences, is essential to promote and generate awareness of the CLS. This includes telling the success stories of Canada's synchrotron, its users and clients as well as promoting positive relationships with internal and external stakeholders, the media and the public. The CLS is recognized by its peer facilities for the professional and innovative nature of its strategic marketing and communications activities.

CLS and the University of Saskatchewan have been continuously working on engaging various stakeholders since starting operations in 2004, in order to obtain commitments toward some portion of the operating costs of the facility. Commitments have been made from a number of different institutions and government programs (NSERC, CIHR, NRC, CFI, WD, U of S) (see Appendix C). In addition, CLS continues to aggressively pursue fee-for-service revenue that will supplement operations (\$10 million over the five year period). This operational budget provides a solid basis for the expenditures connected to this strategic plan.

CLS will continue to utilize various programs and agencies to obtain funding for specific aspects of operations. However, these methods do not allow for the kind of long-term stability necessary to successfully operate a national research facility. In parallel with efforts made by the University of Saskatchewan, other universities and the AUCC, as well as other major research institutions, we will continue to call attention to the need to develop a framework for funding of large science infrastructures in Canada. It is necessary to engage both the political and bureaucratic sections of government, to build strong support in industry, and to actively solicit the support of all levels of government.

CLS has identified a number of strategic, enterprise-level, risks within the University of Saskatchewan enterprise risk management (ERM) process and risk register. The risk management model and process utilized in the U of S ERM program is based on the AU/NZ 4360:2004 *Risk Management Guideline*, which was in turn used as a basis for the new ISO 31000 *Risk Management Guideline* (2009).

Certain elements of a comprehensive risk management system are in place as they are required for safe and reliable operation of the facility. For example, Health, Safety and Environment policies and procedures, a document control system and a quality assurance program are well developed and implemented at the CLS. Governance and management systems are in place to ensure control over strategic and financial risks to the organization.

However, it is necessary to ensure that these risks are evaluated with reference to the overall strategic plans of the CLS. Consideration of interdependencies and mitigation strategies need to be documented to enable regular review and evaluation by management and the Board of Directors. Over the coming year, we will use the existing ERM process included in the U of S plan to develop a more detailed risk register for CLS. To ensure that the plan is comprehensive and well documented, the services of the University of Saskatchewan consultant will be utilized to identify the ERM framework and implementation plan.

Goal 6: Make CLS one of Canada's best employers

By 2013, CLS will employ over 200 staff, including scientists, and technical and business professionals. Continued growth in staffing is necessary to develop and maintain the increasing number of experimental facilities. Many of the highly specialized positions in physical sciences, engineering, information technologies, instrumentation and design which are essential in a leading edge research facility require the attraction of world-class scientists from other countries. There are often only a handful of qualified highly specialized people and CLS must ensure it is competitive with other established international synchrotrons and research facilities.

An initial focus of the Human Resources Management System (HRMS) was the implementation of a comprehensive job evaluation system for the professional, scientific, and administrative employees which was developed with the aid of an external consultant in 2005 (compensation for employees who are members of the Communications, Energy and Paperworkers Union is governed by a collective agreement). This system provides the critical links between the position, the goals of the organization and performance measurement (and resulting compensation) of the individuals performing the duties. It also provides reference to the labour market to ensure that CLS is competitive in its compensation programs.

The most critical factor to CLS success is the performance of its employees. Highly skilled and dedicated scientific, technical and business professionals are required to design, develop, maintain and operate highly technical scientific equipment. While some design efforts capitalized on the intellectual property of other facilities, CLS employees and consultants were encouraged to innovate beyond the current technology (e.g. lattice design, chicaning of insertion devices, superconducting radio-frequency cavities, world leading superconducting wigglers). Some of these design efforts have resulted in the transfer of intellectual property to industry for commercialization and all have resulted in the training and retention of highly motivated scientists and professionals.

Conclusion

This plan was reviewed and discussed not just within the CLS but also by the Board of Directors, the CLS Users Advisory Committee (UAC) and with international advisory groups who review the performance of the machine (Machine Advisory Committee) and the performance of the beamlines, the scientific achievements and future scientific direction of the CLS (Scientific Advisory Committee).

The goals and supporting objectives of this strategic plan chart a path for the continued growth and development of Canada's synchrotron as it strives to realize its potential as a globally leading science facility accountable to its users and stakeholders, responsive to the research and development needs of Canadian scientists in academia and industry, contributing to the advancement of knowledge.