

**Report of the Academic Program Review Panel
For the Department of Computer Science
Memorial University of Newfoundland**

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July, 2012

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1 Summary of the Review Procedures

Members of the Review Panel met with Dr. Mark Abrahams (Dean of Science), Dr. Noreen Golfman (Dean of Graduate Studies), and Ms. Kim. Myrick (Centre for Institutional Analysis and Planning) on the evening of May 23, 2012. This provided a forum for a discussion of general issues regarding the interplay between Memorial University and the Department of Computer Science. Specific issues which the Panel might usefully consider during its meetings with the Department were also highlighted.

Over the following two days, the Review Panel were given a tour of the Department's teaching and research facilities (by the Head). In addition, arranged meetings were held with the following groups. A wide range of topics were covered, including the previous APR (2002), the current Self Study, department initiatives, course offerings and curriculum, space issues, enrollment, collaborations, teaching loads, and research.

1. The Department Head (Dr. Ed Brown) on two occasions.
2. All Faculty Members (nine members were present).
3. Administrative, Instructional, and Systems Staff (approximately nine members were present). Support by these groups of the Department's activities were reviewed and future needs discussed.
4. Panel Lunch with the Department Head and Two Guests (Department faculty members).
5. Members of the Undergraduate Studies Committee.
6. Undergraduate Students (eight were present).
7. Systems Staff.
8. Other Faculty of Science Department Heads. Only the (interim) Head of the Department of Mathematics and Statistics (Dr. Edgar Goodaire) was available.
9. Chair, Electrical and Computer Engineering (Dr. Dennis Peters).
10. Additional Faculty Members via Skype (three).
11. Dean of the Faculty of Science (Dr. Mark Abrahams).
12. Members of the Graduate Studies Committee.
13. Graduate Students (about ten were present).
14. Deputy Head Graduate Studies (Dr. Adrian Fiech).
15. Individual Faculty Members (Dr. Wolfgang Banzhaf).

The excellent organization of the Panel's activities were very much appreciated and the two-day process was executed flawlessly. For this, the Panel wishes to thank the Centre for Institutional Analysis and Planning, and especially Ms. Kim. Myrick and their staff.

However, due to the time of year (about a month after final exams), many faculty members and department heads were out of town. The Panel felt that this led to a reduction in the desired amount of input from these sources and perhaps impacted the Panel's ability to carry out a complete review.

***Recommendation 1-1:** Every effort should be made to ensure that future Academic Program Reviews be held at a time of year that will maximize the likelihood of faculty and unit heads being present for the site visit.*

2 Summary of Key Issues

The principal conclusion of the Panel is that the Department has sufficient resources for fulfilling its goals to deliver excellent undergraduate and graduate programs in Computer Science, to conduct advanced research in this field and to be a vital part of the Faculty of Science and the University and the Community. The Panel also concludes that the Department has made very significant progress since the previous APR, conducted in 2002, but that there are some vital issues which require attention. These issues as well as our recommendations specific to the individual activities of the Department are enumerated in the following major sections of this report. Key areas which have improved over the past decade include the graduate studies program and the number of graduate students, the number of undergraduate courses in application areas, the development of co-op options for undergraduate and graduate studies, cross-appointed faculty and co-supervision of graduate students with other units, more activity in national and international organizations (e.g., conferences), and more initiatives in community outreach programs (e.g., high schools). It was also noted by the Panel that the Department appears to have an excellent support staff for Administration, Instruction and Systems.

A substantial source of the improvements over the past decade appear to be due to the activities of faculty hired in that time frame. This observation is likely relevant to continued advancements of the Department.

Background comments regarding the major areas which require further attention are summarized below in this section, with further details provided in the following sections.

2.1 Undergraduate Studies

The state of the Department's undergraduate studies is the principal concern of the Panel and also the area which could realistically benefit the most from a properly executed im-

provement plan. The number of declared majors has decreased dramatically over the past decade, reflecting an overall decline seen in North America. In addition, the number of service courses given to other units has decreased, notably a second year course which had been taken by a large number of students in the Faculty of Business Administration. Although the Department has periodically updated its undergraduate curriculum, significantly more work needs to be done to make it consistent with other departments in Canada and also to make its offerings more attractive to its own students and to students in other units.

During the interview process with the Panel, many individuals made alarming comments, such as there being a ‘huge problem’ with courses being ‘irrelevant’ with ‘outdated material’ and that students felt ‘really frustrated.’ Another comment was that the ‘undergraduate program was in crisis.’ There were also numerous comments regarding frequently encountered poor instruction, such as ‘cannot stress how bad the teaching is.’ The worst offenders, according to a few of the undergraduate students, appear to be a small number of tenured faculty. Recent hires were viewed as being the better teachers.

There also appears to be a less than ideal system in place for students to obtain guidance and to effect change. Many students felt frustrated in having their views and recommendations ignored. There was also a strong feeling that official channels for advising undergraduate students was frustrating and ‘not particularly helpful.’

The Panel fully recognizes that caution must be exercised in evaluating the negative comments of individuals. However, in the cases cited above (and below) the same general sentiments regarding a specific area of concern were repeated by at least three persons.

2.2 Faculty Research and Scholarship

The Panel believes that the Department’s research output to be lower than other departments within the Faculty of Science. Less than half of the faculty hold NSERC Discovery Grants. We recognize that there are many other sources of funding held by the Department’s faculty but the NSERC success rate remains a useful measure (although less so in recent years). The Department has nine full professors yet only one has an h-index of equal to or above the accepted value of 18 for that position. Only 16 of the 24 faculty members participate in graduate student supervision and only six supervise two or more students. Although six faculty are at or past the normal retirement age, we note that three of these are still research active and two hold NSERC Discovery Grants.

Improvements in these areas can possibly be made through a number of specific recommendations regarding grant application procedures and graduate student enrollments enumerated in the subsequent sections. However, the Panel recognizes that the (typically) more effective path will likely be through a well-defined strategy for new (replacement) hires. This recommendation is discussed further in the following sections.

2.3 Department Harmony

In the previous APR Committee Report, poor communication and disharmony within the Department were noted as being serious problems which were an impediment to its successful function. Although most of these issues appear to have resolved themselves, the Panel heard from several individuals that there remains a significant degree of interpersonal conflict among faculty. One manifestation of these issues is the recent failure of both the current head and the previous head to gain approval from the department for a second term. This may reflect the intensity of systemic problems in the department. The Panel was also made aware that the Department's Self Study Committee was not in full agreement with all the details of the final form of that document.

The issue of finding a new Department Head is thus a particularly important one as that office should, in principle, have the most influence on facilitating communication and harmony among faculty. Any strategy for new faculty hires should also take this issue into consideration.

2.4 Space

During the tour of the Department's facilities, the Panel was made aware of significant fragmentation of the Department's resources due to a lack of sufficient space in a centralized location. The Panel is fully aware that the space problem is widespread within the Faculty of Science but for this Department it is particularly serious. This issue was discussed at length with the Dean of Science and the Panel agrees that there are no easy solutions. Realization of new dedicated space for the Department may not occur for many years.

The Panel feels that there needs to be an effort made by the University, the Faculty and the Department to find an interim solution to the space problem for this Department, possibly through a dynamic allocation of resources (e.g., utilization of space by faculty on sabbatical). This is further discussed in the sections below.

In view of the general nature and seriousness of the issues highlighted above, and the lack of satisfactory progress since the last APR in some of these key areas, the Panel puts forth the following recommendation.

Recommendation 2-1: *A representative from the office of the Dean of Science should be appointed to guide and assist the Department in realizing their goals, such as those adopted from this report, through regularly scheduled meetings with the relevant groups and individuals.*

3 Alignment with the Strategic Plan

The Panel notes that the Self Study Report, some 68 pages excluding appendices, appears to be very thorough and well put together. There are extensive use of tables and charts providing details on enrollments, faculty, research funding and productivity, budget details and more. In addition, the Self Study provides sections on the Department mission, goals and objectives as well as how these fit with the strategic plans of the Faculty and the University. These include the usual major focus areas of improving the teaching environment, high-need areas for research focus, and increased outreach to the community and industry. They appear thorough and appropriate.

3.1 University Citizenship and Community Service

One area that is particularly relevant for this Department is its role as a service provider within the University. As noted in the Self Study, ‘every discipline relies on computing expertise to some degree,’ with the stated vision that ‘The Computer Science Department will be the place that people approach for knowledge and expertise in computing.’ One could argue that, as with mathematics, the use of computers is vital to all areas of science. Every student in the Faculty of Science would benefit from learning how to use computers to help solve science and math problems. Indeed, every student in the university would benefit from an increased knowledge of how computers function and how their use can assist in nearly every academic pursuit.

The Panel believes that there is significant opportunity for the Department to increase its visibility within the Faculty, as well as the University as a whole, and to provide more educational services. The Panel heard of outreach efforts to other units outside the Faculty and also to high schools in the area. The Department has also developed and maintains the University-wide LabNet computing environment which has proven very popular and useful to students and instructors. The Department provides support for the Masters degree program in Computational Science as well as the newly developed undergraduate Computational Chemistry degree. In addition, the Department has been involved in a Distance Learning course on Basic Computing and IT. These important activities should be commended, continued and improved.

The Panel recommends the development a systematic plan to further evaluate the computing needs of students in other departments within the Faculty, as well as other units within the University, and in response to develop targeted course offerings. A recent success in this regard in the first-year programming course, CS1510, which is required by many Math and Physics students. It is noted, however, that the instigation for this course came from outside the Department. Ideally, the Department should embark on a dedicated campaign to advertise itself within the Faculty and the University and to meet with individual units.

The Panel observes that there may be particular opportunity to strengthen collaborations with the department of Mathematics and Statistics.

In view of the very fundamental role that computers and computing play in the activities of the University community, the Department and the Faculty should consider allocating targeted resources to elevate its functionality within the University as a service provider.

***Recommendation 3-1:** The Department should form a standing committee with the purpose to develop a systematic plan to meet with other units in the Faculty and the University in order to advertise the expertise of the Department as well as assess how enhanced computing knowledge would benefit students in other programs, with the ultimate goal to offer courses targeted to fulfill those needs. It is recommended that this committee work closely with the Faculty representative for Marketing and Communication.*

An additional area of concern for the Panel was the minimal amount of interaction with ACEnet, whose directorate is located at Memorial. One could easily imagine that local users of this High Performance Computing facility could benefit from the expertise within the department, possibly in the form of mini-course offerings or student work-term internships. The Panel is not aware of any systematic engagement between these two major computer-focused organizations.

***Recommendation 3-2:** The Department should form a committee with the purpose to explore opportunities to interact with ACEnet by sharing expertise.*

4 Undergraduate Program

A vigorous undergraduate program is a key component of the mission of any academic unit. In this section, the Panel focuses primarily on the undergraduate program for majors, although the Panel will comment briefly on the role played by service courses, as outlined in the section on University Citizenship and Community Service. We discuss enrolments and curriculum separately, although they clearly impact each other.

4.1 Enrolments

The Panel believes that the Department has sufficient resources to deliver a strong undergraduate program to a large number of students. The faculty complement includes a mixture of senior faculty and junior faculty to provide a balanced combination of the long-term perspective in the discipline along with cutting edge topics. The faculty complement is large enough to deliver a range of core and specialty courses that should appeal to a range of students. The technical staff provides excellent infrastructure, and moreover, the cost of providing infrastructure in computer science has decreased significantly over the years.

The Self-Study document acknowledges that the Department has the potential to deliver significantly more instruction. The current level of service teaching is very low, and the teaching of majors seems small relative to the size of the faculty complement and the population of the university's service area. Figure 21 of the Self Study shows that the enrolment is half (or less) of what might be expected given the student population of the university. Thus, the teaching load seems low, not only relative to other units at MUN, but to other units nationally and even regionally.

The Panel met with the Chair of the Department of Electrical and Computer Engineering (ECE) that supports a student stream of similar size. In many universities, ECE and Computer Science units find ways to share programming, as ECE usually has an interest in teaching its students software, and Computer Science usually has a (smaller) interest in teaching its students about hardware. However, the Panel understands there is little or no collaboration at the undergraduate level between these units. This likely has a big impact on the potential enrolment pool for Computer Science.

There are several confounds to keep in mind when analyzing the problem of enrolments in this unit. The Self-Study document states that the number of graduates, as well as the number of course enrolments decreased dramatically since the dot-com and high tech meltdowns that occurred shortly after the year 2000. This would lead some to infer that a good proportion of the declining enrolments are due to forces that are practically global, and certainly are external to the Department, and perhaps impossible for a single university to fight. Additionally, the Self-Study document notes additional decreased enrolments (about 300 enrolments per year) due to the surprise loss of the joint program with the Faculty of Business Administration, and the recent loss of a computing skills requirement in Kinesiology. This might lead some to conclude even more strongly that the problems with enrolments are external to the Department, and beyond its control.

However, departments worldwide have been facing the problem of declining enrolments, and are addressing it by changing their programming. Many departments are now seeing meaningful increases in enrolments and some are reporting strong increases.

The Self-Study document notes that some East Coast universities have an institutional requirement for a computing course, although in the small group meetings, it was suggested to the Panel that there is no champion for this idea at the University. Either way, this line of thinking sidesteps the question of whether it is up to the Department to find ways to make computer science classes more attractive to the mainstream of students.

The Panel heard that some faculty members feel that mainstream computing as synonymous with turning the department into a community college. This argument, and variations thereof, have been made across the country. The Panel does not suggest that the Department compromise the academic integrity of its programs. However, it does suggest that it

ought to be possible to increase the relevance of the course offerings without compromising this integrity.

Recommendation 4-1: *The Department should strike a committee to study what other Departments of Computer Science are doing by way of innovative programs for increasing enrolments. Possibilities include Gaming, Mobile Computing and Social Computing. If there are persons in the department willing to take on this challenge, said persons should be appropriately rewarded both for taking on the challenge, and for any subsequent success. The workload of individuals involved should be structured so that there is no negative impact on either individual or department-wide research productivity.*

Recommendation 4-2: *The Department should conduct an annual exit survey of its graduating students in order to measure their satisfaction with various aspects related to the Computer Science program and identify on-going problems and concerns among students.*

A Co-operative Education Program formally integrates a student's academic studies with work experience. Co-op programs with more than one work term experience provide students with better opportunity for career exploration. An accredited co-op program provides such opportunity by requiring students to take at least four co-op work terms. Moreover, a well-structured accredited co-op program will help the Department build strong relationships with local ICT industry. It will help with the recruitment when the prospective students know that they can 'earn while learn'.

Investigation and development of pedagogical alternatives will require an alignment of resources, but the Panel believes that resources are in place. As already mentioned, the Department itself has resources to teach a much bigger load. Even more time could be freed up by offering poorly subscribed classes with less frequency, and by finding ways to collaborate with ECE. There are other resources as well. For instance, the Panel heard that some department members were not aware that the Faculty provided support for outreach programs, and there may be other resources available.

Recommendation 4-3: *The Department should consider an accredited co-op program.*

4.2 Curriculum

The Panel looked at the undergraduate program as presented in the Self Study and other documents. Significantly more work needs to be done to make it consistent with other departments in Canada and also to make its offerings more attractive to its own students and to students in other units. It is difficult to determine this from an analysis of the text of calendar entries, course outlines, or program descriptions. Rather, the problem appears to be systemic, and the concerns we have arose from discussions with the stakeholders. Various

groups and individuals made comments about the quality of instruction. Other units in campus have lost interest in what Computer Science is offering. Some faculty seem to have given up. Student evaluations of teaching are low. The program seems to have grown in an ad hoc fashion. Some courses are well out of date. Exams are circulating around that are decades old but still being used. Some concerns raised by students included: Certain courses appear to be unnecessary bottlenecks, some courses are offered in inconvenient sequences, the program is too theoretical, certain material is repeated unnecessarily, faculty do not know how to program, and so on.

While it is not uncommon for students and faculty to disagree on curriculum matters, the Panel was surprised by the unanimity, intensity, and negativity among students regarding problems with the delivery of undergraduate courses.

The students did make some positive statements. They acknowledged that some faculty are making an effort to provide interesting, challenging and relevant classes, but they are in the minority. Students found the Help Centre good, for the first two years, liked the Instructional Assistants, and reported there is a good sense of community among the students. Overall, the Panel was troubled by the overall tone of the discussion with the students.

The Panel also met with the Undergraduate Committee. The Undergraduate Committee explained the low enrolments by noting that enrolments had declined globally, and explained the concerns of students by saying that students will always complain. The Undergraduate Committee did not express a high level of concern about these perceived problems with the undergraduate program.

The Panel is of the view that the concerns with the undergraduate curriculum cannot be addressed by an analysis of paper descriptions like calendar entries and course outlines. Rather, there seems to be a fundamental disconnect between the way these descriptions are being interpreted by students and by faculty. The anecdotal evidence provided to the Panel suggests that the program had developed in a piecemeal fashion, with courses being added as the faculty complement increased, and perhaps not taking time to think about the program's overall design. Presently the Department is not accredited by any agency such as the Canadian Information Processing Society, (CIPS), as are many Canadian Computer Science Departments. This is not necessarily a bad thing. The Panel notes that at least one high-profile computer science department (at the University of Alberta) has chosen to give up CIPS accreditation in favour of increasing flexibility of its undergraduate offerings as the discipline changes, in particular, as regards inter-disciplinary work. The Self-Study Document states that this is the reason the Department chose against accreditation as recommended by the previous APR.

On balance, the Panel feels that the Department's undergraduate program might nonetheless benefit from the reorganization and introspection that a CIPS accreditation would entail.

Recommendation 4-4: *The Department should reconsider CIPS accreditation. Should CIPS accreditation not be desirable, the Department should consider the following: 1. An outcomes-based analysis of its course offerings by way of providing greater clarity in terms of what faculty are expected to teach, and what students can expect to learn. Low-level outcomes should be clearly specified for each course, so that students can set their expectations. 2. Make recommendations to improve the reward structure for successful teaching. The Panel did not have time to understand all aspects of the faculty contract, but suggests that those who achieve success in teaching, whether through positive student evaluations, recognition by their peers, improvement of enrolments, be recognized in concrete ways. While doing this, the Department must be mindful of its research mission. The latter recommendation might be guided by using the ACM curriculum as a model.*

In view of the importance of its undergraduate program and of the many challenges facing the Department in improving enrollment and the curriculum, the Panel recommends that a dedicated champion be found to facilitate the required changes.

Recommendation 4-5: *The Department should consult the Faculty in the creation of a permanent position of Deputy Head of Undergraduate Studies, with the appropriate compensation.*

5 Graduate Program

The growth of the Graduate Program since the last Academic Program Review has been impressive. In 2001-2002, the Department had eight graduate students (four MSc and four PhD). Presently, there are about 40 graduate students, of which 30% are PhDs. This growth is largely attributable to a conscious plan on the part of the Department's leadership since that time. Following the last review, the Department brought in an external research-active head who argued for a several new research positions. This combination of circumstances provided critical mass, mentoring, and collaboration for those who wished to pursue research careers. The tone of the discourse with stakeholders in the graduate program differed strikingly from that with the stakeholders in the undergraduate program. The graduate students spoke positively about the quality of their courses and the quality of research they were engaged in. As might be expected in a smaller program, some students found themselves working alone on a problem, rather than working with a team.

The Panel heard of at least two initiatives, a co-op Master's degree and/or a course work Master's degree. Both have the potential to attract a different kind of student, and have minimal impact on the overall research productivity.

Recommendation 5-1: *The University and the Faculty of Science should continue to monitor and encourage progress and growth of the Department's graduate program.*

Recommendation 5-2: *The University, the Faculty and the Department should explore creative ways to increase the engagement of faculty in the goals of success for the Department's graduate and undergraduate programs.*

Recommendation 5-3: *The Department should conduct an annual exit survey of its graduates to obtain feedback in order to measure their satisfaction with various aspects related to the Computer Science program, evaluate the effectiveness of its programs and identify ongoing problems and concerns among students.*

6 Research and Scholarship

The Self-Study Report included charts and tables and CVs of individual faculty members. The information provided, usually as totals or averages, made it difficult to properly evaluate productivity. The Panel also found it difficult to compare and extract pertinent information from the CVs since there was no consistent format followed. This was also mentioned in the 2002 Report, "...the CVs we received were sometimes vague, some were missing relevant information ...".

Recommendation 6-1: *For the next APR the Department should ask faculty members to provide their CV using a standard format for the Self-Study. The Panel recommends that faculty use an NSERC form 100 style CV. It should be noted that NSERC only considers the last six years.*

6.1 Research Productivity

The Department has made significant progress since the last APR. From 2003-10 the total number of journal articles almost tripled, peaking in 2008. The average number of publications per research active faculty is now about 3.0 publications per year per research active faculty. If only journal articles are included the average, for 2006-2010, is closer to one publication per year per research active faculty. One measure of the quality and impact of the publications is the h-index, which takes into account the number of citations and the number of publications. Only eight faculty members have an h-index greater than 10 and 16 faculty members have an h-index below 10.

The Panel perceived that there could be unexplored potential for an increase in intra-Departmental collaborations. These could be fostered by enhancing the regular Departmental seminar series. An example would be that each research active faculty be encouraged to have a seminar given by a member of their group at least once per year. Attendance at seminars also could be enhanced. The benefit from more inter-departmental

research collaborations could be many-fold. In addition to combining research dollars for optimal use, sharing of graduate students might facilitate an increase in their numbers.

Recommendation 6-2: *The Department should explore means by which to create an environment that will foster intra-departmental research collaborations. The regular department seminar series could be used as a platform for this purpose, with a dedicated Seminar Committee that investigates incentives for continued increases in attendance.*

6.2 Funding

The total number of grants and the total dollar amount of grants administered within Computer Science has grown from 2003-2009, mainly due to the hiring of new faculty. There is however, a downward trend from 2009 to 2011. Currently only 11 faculty members hold research grants. In the last NSERC competition only two out of six applicants were successful. The average NSERC grant per year per faculty member has decreased from approximately \$31k in 2009-2010 to \$17k in 2011-2012.

Recommendation 6-3: *The Department needs to invest significant effort in funding opportunities. All grant applications should be reviewed by an internal committee to ensure that they are of the highest possible quality.*

6.3 Graduate Student Supervision

Currently eight faculty members do not supervise graduate students and only six faculty members supervise two or more students. This may explain the high rejection rate in the last NSERC competition. Contribution to HQP is an important component in the evaluation of NSERC Discovery grants. In the Self Study it was pointed out that some faculty members, including newer faculty, expressed disappointment with prior supervisory experience and for that reason were reluctant to commit to student supervision.

Although progress has been made, based on recent trends in productivity, funding and graduate student supervision, the Department is at a critical stage. The Department has the lowest Faculty of Science efficiency measure. To deal with these issues the following three recommendations are made.

Recommendation 6-4: *The Department should invite a member of the Grant Selection Committee (GSC) to give a presentation to the Department and also request the chair of the GSC to provide a powerpoint presentation.*

Recommendation 6-5: *Mentors should be assigned to newer faculty members in order to*

ensure that they are made aware of funding opportunities, the importance of graduate student supervision and the need for strong research proposals.

Recommendation 6-6: *The Department should continue to develop its research plan as a living document and maintain its alignment with the University's strategic plan. The Department should establish and focus on its areas of strength.*

7 Faculty and Staff

Currently the Department has nine full professors, 11 associate, two assistant, two lecturers, two joint appointments and six cross appointments. Due to a failed spousal hire, one assistant professor has recently accepted a position at another university. The loss of this research active faculty member will impact research productivity. The Department stands to lose additional faculty in the years ahead. With 13 faculty past the age of 55, and four past the age of 65, retirements are bound to happen soon, and with the decrease in teaching requirements due to the Faculty of Business Administration no longer requiring Computer Science courses, retirements may not be replaced, resulting in research faculty taking on additional teaching and administrative work. But doing this, along with reduced faculty renewal, the Department risks losing the gains made since the last APR

Recommendation 7-1: *The Department needs a long-term plan for faculty renewal. The Department must first determine the number of faculty members required to cover teaching and administrative duties. The Panel suggest that the Department negotiate a new hire for every two retirements or departures.*

Currently the Department has sufficient technical support (seven systems staff), administrative support (four) and instructional support (four). If the graduate program grows substantially the Department may need a dedicated graduate secretary. The staff was highly praised by both the faculty and the students. The Department needs to monitor on a regular basis the job satisfaction level of each staff member to ensure this area of the Department's activity remains at its high level of excellence. An example is LabNet.

Recommendation 7-2: *The Department should consider a means by which to recognize and reward the efforts of its staff members, both internally and by the Faculty of Science and the University.*

8 University Support

8.1 Space

The only substantial issue regarding university support communicated to the Panel involved inadequate and decentralization of space resources. The principal space for the Department is within the Faculty of Engineering and appears to be roughly 30% too small for the needs of the Department. Six faculty offices are located in the sixth floor of the Earth Science building, about a 5 minute walk from the main Department. In addition, the Computer Science undergraduate student lounge is shared with the Earth Science students, located in the Earth Science building. We heard from the undergraduate students that they are treated somewhat as outsiders by the Earth Science students. There are also four offices in Earth Science used by Computer Science graduate students and postdocs.

For any department, this fragmentation of space would not be good for the promotion of communication, interactions and impression on students. For this Department, it is probably contributing to the previously mentioned harmony issues if for no other reason than by reducing the chances for face-to-face encounters. The undergraduate students are certainly disappointed that they do not have their own space. This issue is likely exacerbating the aforementioned problems with the undergraduate program perceived by the students and cannot be helping enrolment.

Rather than waiting many years for new dedicated space, the Panel feels that efforts be focused on immediate, although temporary, relief.

***Recommendation 8-1:** The Department should form a Space Committee with the purpose to explore opportunities for the optimal use of the rooms already allocated within the present location (e.g., better use of temporarily vacant offices and seminar rooms). In addition, the committee should seek increased allocation of space within the Faculty of Engineering for Department use. The committee should ask the University for support and seek joint meetings with representatives from the University, the Faculty of Science, and the Faculty of Engineering.*

9 Plans, Goals, and Resource Allocation

The Self Study contains separate sections on (1) Goals and Mission and (2) Strategic Objectives. There are seven items listed in the latter category. The first deals with communicating ‘the strategic importance of the Computer Science department to the Memorial University community’ and is covered above in Sect. 3-2. Another targets the development of partnerships with local industry. It can be expected that the undergraduate and graduate co-op programs will help foster such collaborations but the Department needs to investigate further opportunities for funding through NSERC (and other) programs which are increasingly

designed to encourage such partnerships. It was clear to the Panel that not all of the faculty members were aware of such programs (such as the NSERC Engage grant). Opportunities from other funding agencies also need to be explored on a regular basis.

Recommendation 9-1: *The Department Head should organize annual information sessions to be conducted by a Grants Facilitation Officer, Dean of Science Office, to review national and provincial funding opportunities available to Department faculty.*

Other objectives listed in the Self Study include developing Strategic Research Areas, becoming a Top Ten Destination in Canada for Graduate Students, attracting the Brightest High School Students, offering a Modern Curriculum and engaging Alumni as Brand Ambassadors. These are worthy objectives but need to receive some attention if to be realized. The Department has been holding regular annual retreats. These need to continue and to have some follow-up action items.

Recommendation 9-2: *The Department should continue to hold annual retreats in order to assess current activities, target areas for improvement, and to update strategic objectives. These events should result in follow-up action items delegated to various standing and ad hoc committees who can provide regular updates to the Department on their progress.*

10 Summary of Recommendations

Recommendation 1-1: *Every effort should be made to ensure that future Academic Program Reviews be held at a time of year that will maximize the likelihood of faculty and unit heads being present for the site visit.*

Recommendation 2-1: *A representative from the office of the Dean of Science should be appointed to guide and assist the Department in realizing their goals, such as those adopted from this report, through regularly scheduled meetings with the relevant groups and individuals.*

Recommendation 3-1: *The Department should form a standing committee with the purpose to develop a systematic plan to meet with other units in the Faculty and the University in order to advertise the expertise of the Department as well as assess how enhanced computing knowledge would benefit students in other programs, with the ultimate goal to offer courses targeted to fulfill those needs. It is recommended that this committee work closely with the Faculty representative for Marketing and Communication.*

Recommendation 3-2: *The Department should form a committee with the purpose to explore opportunities to interact with ACEnet by sharing expertise.*

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Recommendation 4-2: *The Department should conduct an annual exit survey of its graduating students in order to measure their satisfaction with various aspects related to the Computer Science program and identify on-going problems and concerns among students.*

Recommendation 4-3: *The Department should consider an accredited co-op program.*

Recommendation 4-4: *The Department should reconsider CIPS accreditation. Should CIPS accreditation not be desirable, the Department should consider the following: 1. An outcomes-based analysis of its course offerings by way of providing greater clarity in terms of what faculty are expected to teach, and what students can expect to learn. Low-level outcomes should be clearly specified for each course, so that students can set their expectations. 2. Make recommendations to improve the reward structure for successful teaching. The Panel did not have time to understand all aspects of the faculty contract, but suggests that those who achieve success in teaching, whether through positive student evaluations, recognition by their peers, improvement of enrolments, be recognized in concrete ways. While doing this, the Department must be mindful of its research mission. The latter recommendation might be guided by using the ACM curriculum as a model.*

Recommendation 4-5: *The Department should consult the Faculty in the creation of a permanent position of Deputy Head of Undergraduate Studies, with the appropriate compensation.*

Recommendation 5-1: *The University and the Faculty of Science should continue to monitor and encourage progress and growth of the Department's graduate program.*

Recommendation 5-2: *The University, the Faculty and the Department should explore creative ways to increase the engagement of faculty in the goals of success for the Department's graduate and undergraduate programs.*

Recommendation 5-3: *The Department should conduct an annual exit survey of its graduates to obtain feedback in order to measure their satisfaction with various aspects related to the Computer Science program, evaluate the effectiveness of its programs and identify on-going problems and concerns among students.*

Recommendation 6-1: For the next APR the Department should ask faculty members to provide their CV using a standard format for the Self-Study. The Panel recommends that faculty use an NSERC form 100 style CV. It should be noted that NSERC only considers the last six years.

Recommendation 6-2: The Department should explore means by which to create an environment that will foster intra-departmental research collaborations. The regular department seminar series could be used as a platform for this purpose, with a dedicated Seminar Committee that investigates incentives for continued increases in attendance.

Recommendation 6-3: The Department needs to invest significant effort in funding opportunities. All grant applications should be reviewed by an internal committee to ensure that they are of the highest possible quality.

Recommendation 6-4: The Department should invite a member of the Grant Selection Committee (GSC) to give a presentation to the Department and also request the chair of the GSC to provide a powerpoint presentation.

Recommendation 6-5: Mentors should be assigned to newer faculty members in order to ensure that they are made aware of funding opportunities, the importance of graduate student supervision and the need for strong research proposals.

Recommendation 6-6: The Department should continue to develop its research plan as a living document and maintain its alignment with the University's strategic plan. The Department should establish and focus on its areas of strength.

Recommendation 7-1: The Department needs a long-term plan for faculty renewal. The Department must first determine the number of faculty members required to cover teaching and administrative duties. The Panel suggest that the Department negotiate a new hire for every two retirements or departures.

Recommendation 7-2: The Department should consider a means by which to recognize and reward the efforts of its staff members, both internally and by the Faculty of Science and the University.

Recommendation 8-1: The Department should form a Space Committee with the purpose to explore opportunities for more the use of the rooms already allocated within the present location (e.g., better use of temporarily vacant offices and seminar rooms). In addition, the committee should seek increased allocation of space within the Faculty of Engineering for Department use. The committee should ask the University for support and seek joint meetings with representatives from the University, the Faculty of Science, and the Faculty of Engineering.

Recommendation 9-1: *The Department Head should organize annual information sessions to be conducted by a Grants Facilitation Officer, Dean of Science Office, to review national and provincial funding opportunities available to Department faculty.*

Recommendation 9-2: *The Department should continue to hold annual retreats in order to assess current activities, target areas for improvement, and to update strategic objectives. These events should result in follow-up action items delegated to various standing and ad hoc committees who can provide regular updates to the Department on their progress.*