SIMON FRASER UNIVERSITY

Senate Committee on University Priorities
Memorandum

TO: Senate

FROM: John Waterhouse
Chair, SCUP
Vice President, Academic

RE: Department of Earth Sciences External Review

DATE: October 6, 2004

The Senate Committee on University Priorities (SCUP) has reviewed the External Review Report on the Department of Earth Sciences, together with a response from the Department of Earth Sciences, the Dean of Science and input from the Associate Vice-President, Academic.

Motion:

> That Senate concurs with the recommendations from the Senate Committee on University Priorities concerning advice to the Department of Earth Sciences on priority items resulting from the external review as outlined in S.04-80

The report of the External Review Committee for the Department of Earth Sciences was submitted on April 19, 2004 following the review site visit which took place March 24 – 26, 2004. The response of the Department Chair was received on June 2, 2004 followed by that of the Dean of Science on July 9, 2004.

SCUP recommends to Senate that the Department of Earth Sciences and the Dean of Science be advised to pursue the following as priority items:

1. <u>Space</u>

1.1 SCUP, the Dean of Science and the Associate Vice-President, Academic recognize the importance of providing adequate space to the department and agree to work with the department to resolve this issue.

2. Undergraduate Program

2.1 SCUP recommends that the Department develop an undergraduate student handbook to inform students of program requirements, scholarships, safety issues, facilities available and career opportunities.

2.2 SCUP recommends that the Department increase the technical support for students in the form of a Technician, and is grateful to the Dean for providing the required funding for this.

2.3 SCUP recommends that the Faculty of Science consider having Earth Science courses included as required courses in other programs.

3. Graduate Program

3.1 SCUP recommends that the Department develop a graduate student handbook to inform students of program requirements, scholarships, safety issues, facilities available and career opportunities.

3.2 SCUP recommends that the Department develop a core of graduate courses independent of the undergraduate program to support the new PhD program.

3.3 SCUP recommends that before expanding the graduate program, financial and other resources need to be reviewed for their adequacy by the Department and the Faculty of Science.

4. Administration

4.1 SCUP recommends that the Department revise its constitution in consultation with the Dean of Science.

4.2 SCUP recommends that the Department undertake a Strategic Planning process within the Department which would improve team spirit, increase understanding and improve the alignment of issues and priorities.

SIMON FRASER UNIVERSITY

SCUP 04 – 029

Office of the Dean of Science

MEMORANDUM

TO:	W.R. Krane Associate Vice-President, Academic	FROM:	Dr. Michael Plischke, Acting Dean Faculty of Science
RE:	**External Review of Earth Sciences**	DATE:	July 8, 2004

I am writing in regard to the External Review Report of the Department of Earth Sciences and the response from the Department, dated June 2, 2004. I must say that I find the report of the review committee to be singularly unhelpful since many of the recommendations are either of the "motherhood" variety or unworkable. However, I will comment on the report in the same format as was used by the reviewers.

Undergraduate Program

There are eleven recommendations under this heading. All but three of them can be acted on (or not) by the Department without help or hindrance from the Dean's Office. The three that involve Faculty level action are recommendations seven, nine and eleven.

Recommendation 7: The review committee recommends additional technical support for the Department. I have made available a second full-time technician's position to the Department.

Recommendation 9: The committee recommends that the Department consider collaborative programs with other departments in order to build enrollments in its courses. A natural target group of undergraduates would be the students in the Environmental Science Program that is administered through the Dean's office. These students indeed are not required to take many EASC courses, probably because the program was developed before the creation of the Department of Earth Sciences. I will ask the Program Director and his Advisory Committee to consider the question of whether or not EASC courses could be substituted for at least some of the Geography courses in the various streams.

Recommendation 11: The committee suggests financial support if Earth Sciences undergraduates host the WIGUC conference. I am prepared to recommend support from the VP Academic's conference fund and to provide some support from the Faculty.

Graduate Program

I will comment on recommendations three, four, nine and ten.

Recommendation 3: *"The Department should develop a core of graduate courses that are independent of the undergraduate program..."*. I fully agree with this recommendation.

Recommendation 4: The committee suggests that TAs should be funded independently of their teaching duties. I don't see how this can be done to any large extent, given the shortage of resources to support graduate students across the University and the existence of a collective agreement.

Recommendation 9: *"The graduate program will require additional resources, including financial support to students, access to infrastructure, and an increase in the quantity and quality of space if the graduate program is going to grow."* This is undoubtedly true.

Recommendation 10: *"The University should provide appropriate office space for graduate students."* The graduate students in all the experimental disciplines have desk space in their laboratories. This is an unfortunate situation, certainly from a safety perspective, but there is not much to be done unless a great deal of extra space becomes available.

Research

The first three recommendations deal with the amount, quality and location of the space available to the Department. At the time of the review, it was not known that when the Department moves into TASC I, it will retain three rooms in ASB and the K section of Science with a total area of roughly 200m^2. The location of these rooms is somewhat unfortunate, given their distance from TASC I. Discussions are under way with the Associate Dean of the Faculty of Applied Sciences regarding a trade of that space for an equal area in either SCB or TASC I. The quality of the space in TASC I is, presumably, excellent as it was designed by the Department.

The space in SCB currently under discussion is ideal for teaching laboratories, if not for research.

The issue of allocation of space across the Faculty has been raised in both of the external reviews conducted this year. The MBB review committee recommended an external space audit and I expect that we will have such an audit carried out.

The remaining two recommendations do not require comment.

Administrative Service

In the preamble to the recommendations, the committee notes some administrative difficulties including *"occasional tardy responses from the Dean's office"*. I have no idea what they are talking about.

The committee recognizes that there have, in the past, been some unfortunate interactions between department members. The current Chair has worked hard to create a civil atmosphere inside the Department. I do believe that tensions will automatically be lowered when the Department moves into less crowded accommodations. In the meantime, I will do what I can to provide support to the Chair in her efforts to foster collegiality.

Recommendation 1: *"... rewrite/replace or abandon (preferably) the (Departmental) constitution in consultation with the Dean..."*. I couldn't agree more. The existing constitution prevents efficient administration and handcuffs the Department Chair.

Recommendation 3: This has been addressed in the context of the undergraduate program.

Recommendation 11: *"The Department exists largely as an unsupported orphan in the Faculty of Science and requires a commitment of resources from the Faculty and from the senior administration if it is to be successful and sustainable."* I take some exception to this statement. The Faculty has made available to the Department a Tier I and a Tier II CRC. Physics, which is twice the size of Earth Sciences only has two CRCs and Biosciences which is roughly three times as large also only has two. Admittedly the current space occupied by Earth Sciences is not adequate but help is on the way. Both Physics and Chemistry have willingly accommodated Earth Sciences research and teaching activities inside "their" precinct and Statistics has loaned the Department a modest amount of office space.

Major Issue Arising: Space

As already discussed above, the committee has not appreciated that Earth Sciences will retain a substantial amount of space in the Science area when the bulk of the Department moves into TASC I. Separate from the ASB and K rooms which we are attempting to trade, Earth Sciences will also retain use of the "dungeon" section of the Physics 7000 level. This is a lab roughly 1400 sq. ft. in area, *i.e.*, not insignificant.

We will continue to discuss the allocations inside TASC I with the Faculty of Applied Sciences but I am not optimistic that much can be achieved in this context at the decanal level.

M. Plischke

Michael Plischke

c: Diana Allen

EARTH SCIENCES
SIMON FRASER UNIVERSITY
8888 University Drive
Burnaby, BC, V5A 1S6

Telephone: (604) 291-5387, Fax: (604) 291-5481

To: Dr. William Krane, Associate VP Academic

From: Dr. Diana Allen, Chair, Dept. of Earth Sciences

Subject: Earth Sciences Response to the External Departmental Review Document

Date: June 2, 2004

Attached you will find a copy of the Earth Sciences Response to the External Departmental Review Document. I have forwarded a soft copy of this response to Barbara Wepruk, in your office.

Diana Allen

/wb

RESPONSE OF THE EARTH SCIENCES DEPARTMENT TO THE COMMENTS/RECOMMENDATIONS OF THE EXTERNAL REVIEW TEAM

PREPARED BY DR. DIANA ALLEN
DEPARTMENT OF EARTH SCIENCES
SIMON FRASER UNIVERSITY
MAY 27, 2004

KEY POINTS

1. The issue of space, or lack there of, was an overriding concern throughout the Departmental Review committee's report, and is the overriding concern of the Department. Space has been on ongoing issue since the inception of the Department and is presently constraining our growth. To summarize our reply to the space-related issues raised by the external review team:
    - Our three new faculty, Williams-Jones, Coffey and Gibson (September 2005) will be required to share 60m^2 of classroom space as research space and graduate student accommodation.
    - Neither of the two research chairs, Doug Stead (Endowed FRBC Chair) nor John Clague (CRC Tier I), have research labs; they have small annexes situated outside their offices, which house graduate student desks.
    - We have recently nominated a CRC Tier II, Gwenn Flowers, and have no office space left or lab space to offer her when she arrives in January 2005.
    - We have no space for sessional lecturers, post-doctoral fellows, adjuncts and visiting scientist (offices or lab space).
    - This Department is too fragmented and has offices and labs in several areas on campus (ASB9701 and 9703; K9507, P9304, SCK 7000 level; C9015 and for a period in Maggie Benston and Centre for Coastal Studies).
    - The new building will go a long way to helping us consolidate, which will undoubtedly help with improving collaboration and everything that goes along with that, and we hope that the University will reconsider its decision to allocate what was once Earth Science space in TASC1 to Computing Science.
2. The Department requires additional technical support. One additional technical support person was identified as a need in our three year plan. Current technical support consists of one person, despite the fact that the faculty compliment has increased by approximately one third, and graduate program has more than doubled since that position was established. Additional technical support was one issue raised by the external reviewers for the proposed PhD program. As suggested by the review team, we may wish to consider tailoring that position to include lab instructor duties as well as providing general technical help.

1. Factual Errors

We wish to correct two statements of fact presented in the introduction and undergraduate program, respectively.

1. The Department presently consists of 13.5 faculty members. Dr. Ted Hickin holds a point five appointment in Earth Sciences, and Dr. Brian Coffey joined the Department in January 2004.
2. The current complement of faculty and courses generally allows students to meet the present requirements for professional registration in two of the four streams, Environmental Geoscience and Geology; however, students must take several courses outside of Earth Sciences. The changes to the Environmental Stream, which will come into effect in 2006, will similarly require additional courses be taken outside of Earth Sciences.

2. Response to the Recommendations Regarding the Major Issue Arising: Space

Recommendation 1: It is imperative that immediate space pressures are alleviated. The current situation cannot continue until the TASC 1 building is built.

The Department agrees with this recommendation. We are currently, and have been for several years, experiencing a severe space crisis. In recent weeks, following receipt of the reviewer's report, the Dean of Science has offered space to Earth Sciences in Discovery Park. Both the Departmental Space Committee and the full Department have considered this offer and state emphatically that the space is inappropriate for our activities. This is office space in an office complex, and while we could use additional office space to house Gwenn Flowers in January 2005, the sessional lecturers, the visiting professors, and the adjuncts as well as graduate students, the last thing we need is to be separated even further. This Department is already too fragmented and has offices and labs in several areas on campus (ASB9701 and 9703; K9507, P9304, SCK 7000 level; C9015 and for a period in Maggie Benston and Centre for Coastal Studies). The new building will go a long way to helping us consolidate, which will undoubtedly help with improving collaboration and everything that goes along with that. However, to fragment us more at this stage is unacceptable.

Recommendation 2: Re-evaluate the space allocation in the TASC I building in light of new space opportunities available to Computer Science at the new Surrey campus and declining enrollments in Computer Science.

We agree with this recommendation and hope that the University will reconsider its decision to allocate what was once Earth Science space in TASC1 to computing science. As a result of the loss of space in TASC1 to Computing Science, we do not have sufficient teaching lab space. Specifically, we will require immediately two teaching labs - one with water and one without that can be used for upper level lab courses involving groundwater science and engineering science, and microscopy and mapping, respectively. There are no plans for where we will set up those labs although some discussion has been made about assigning us ASB9701/3, which would require extensive renovations but will nonetheless have no water. Continued use of SCK labs would be a good compromise as these labs are across the road from TASC1, but these labs have apparently been allocated to Communication.

Recommendation 3: Any new space allocations should be adequately serviced for their intended function (eg., air conditioning for computers).

We agree with this recommendation. Air conditioning, water, fumehoods, etc. are all necessary infrastructure for research and teaching activities by many faculty.

4. Response to the Recommendations Regarding Research

Recommendation 1: Re-evaluate the space allocation to Earth Sciences in light of the growth in the research program. It is important to position the space allocated to the Department close to TASC 1.

The Department agrees with this recommendation. We are currently, and have been for several years, experiencing a severe space crisis and hope that the University will reconsider its decision to allocate what was once Earth Science space in TASC1 to computing science.

Recommendation 2: The Department and University need to provide appropriate support and research space to the CRC and endowed chairs.

The Department agrees with this recommendation. This is a major problem at the present time. Neither Doug Stead (Endowed FRBC Chair) nor John Clague (CRC Tier I) have research labs. They have small annexes situated outside their offices, which house graduate student desks. There are no laboratory facilities for either one.

Recommendation 3: Further research development and growth in the Department will require additional space of an appropriate type to house new infrastructure. Money available to researchers to purchase new infrastructure should be spent and the University should provide appropriate space to accommodate this infrastructure.

John Clague has held off in purchasing equipment from his CFI grant because there is no appropriate space available to house the particle analysis equipment. The only space available is in the Centre for Coastal Studies (on the other side of campus), which will require renovations to provide water. Similarly, Doug Stead does not have a research lab or a dedicated teaching lab for soil and rock mechanics courses. The FRBC chair is mandated to provide instruction in this area. Equipment money is available, but there is no where to house the equipment. Space had been promised by the university, but is not forthcoming. Finally, we have recently nominated a CRC Tier II, Gwenn Flowers. We have no office space left or any lab space. Our three new faculty are sharing $60m^2$ of classroom space as research space and graduate student accommodation.

Recommendation 4: The Department should continue to develop existing collaborations and look for new collaborative opportunities.

The Department agrees with this recommendation and will continue in its efforts to foster current collaborations and to collaborate both within the university and outside more widely than is currently done.

Recommendation 5: The Department should explore opportunities with industry to provide additional resources to support graduate student research and to increase the awareness in the Geoscience community of the SFU program.

Efforts need to be made by individual faculty to pursue other sources of funding besides NSERC Discovery grants. Faculty members should be encouraged to seek industrial support in order to augment research funding, and thus, graduate support. The Department recognizes that its funding support is not high in comparison to other Faculty of Science Departments.

4. Response to Undergraduate Program Recommendations

Recommendation 1: An undergraduate student handbook should be written to give particular advice to Earth Science undergraduate students. This handbook should highlight program requirements and expectations, scholarships available, safety issues in labs and in the field, departmental facilities and available infrastructure, career opportunities and ways to access relevant information.

The Department views this as an excellent idea. At present students rely on APEG BC course planning documents and an internal course planning document, as well as the university calendar. We have already initiated the preparation of this handbook.

Recommendation 2: The Department should continue to develop the undergraduate program to allow students' equal opportunity to complete either the Environmental Science or the Geology stream as accredited by APEGBC.

Prior to the review, the Department had identified streaming as a necessary modification to the undergraduate program. A preliminary draft of two streams has already been prepared and is currently being discussed by the Undergraduate Curriculum Committee.

Recommendation 3: The Department must ensure that the sequencing of courses and alternation of courses to accommodate the limited student numbers allow a student to complete either of the Earth Science programs in four years if the student is working at full load.

The sequencing of course offerings has been poorly organized in recent years, largely on account of having limited instructors (prior to hiring K. Cameron), a bottom-heavy compliment of faculty who were all eligible for study leave at the same time, the departure of a faculty member, and lack of long-term planning for course offerings. One of the first activities of the new chair (D. Allen) in September 2003 was to update the coarse planning and faculty workload spreadsheet and extend it for several years into the future. A three year teaching schedule (with some room for contingencies) was circulated to the faculty in the early fall of 2003. Course planning now extends several years hence, but will need to be modified slightly to take into account streaming. The courses at each year are now balanced (same number of courses in fall and spring semesters) and an attempt has been made to redistribute upper division courses to allow for better sequencing.

Recommendation 4: While recognizing the need to limit the number of courses at a senior undergraduate level, the Department might offer, on a trial basis, senior undergraduate courses that give faculty members a greater opportunity to expose students to their areas of interest and expertise.

To a large extent this is already being done. In fact, we have a large number of upper division courses (many more than our lower division offerings), and all faculty currently teach upper division courses (with the exception of new faculty who have just begun and the two lecturers who generally teach lower division courses). In fact, it might be said that we have too may upper division courses on the books and not enough faculty to teach them. Consequently, most of the 3rd and 4th year courses that are electives for our majors (not part of the core program) are taught every second year. In addition, with such limited enrolment, faculty are encouraged to offer directed readings courses in their area of specialization.

Recommendation 5: The Department should focus attention on trying alternatives to increase undergraduate enrollments by expanding course offerings at the first year level to improve recruitment potential.

A major initiative of the Department is to increase lower division enrolment by building up the breadth of offerings at the first year level. We recognize that boosting first year enrolments is critical to the success of the Department in all respects. Because Earth Sciences courses are not included in the major requirements for any other department in the Faculty of Science (or elsewhere), attracting first year students into the program is very difficult. Nevertheless, we have introduced a first year lab-based Dinosaur course that is intended to be a breadth and writing intensive course. This fall, we will be offering a new course on Geohazards (volcanoes, earthquakes, etc.), which will be a lecture only course to target a different student market, and we are offering a field-based sequel to the Geohazards course in the spring of 2005. In addition, we have initiated discussion in the Undergraduate Curriculum Committee to shift one of our less subscribed courses (EASC 102) to the second year, and introduce an "Earth System Science" course or "Geology and the Environment" Course that can be taught both at the Burnaby campus and at the new Surrey campus as part of the first year science offerings.

Recommendation 6: The Department should continue to explore the development of introductory courses that do not require a laboratory to attract students and enhance undergraduate enrollment, and by encouraging the transfer of students from other disciplines into the Department at the second-year level who have developed an interest in Earth Sciences.

The first part of this recommendation has been addressed above. The reorganization of our first year pre-requisites (i.e., shifting 102 to the second year) may help to encourage students in other departments to transfer to Earth Sciences because they will be able to enter second year having only a single first year Earth Science course. This change is not expected to impact college transfer in any negative way.

Recommendation 7: The Department requires additional technical support. This person could also serve as a dedicated Laboratory Instructor who would responsible for the maintenance and curation of the collections used to support the undergraduate programs.

One additional technical support person was identified as a need in our three year plan. Current technical support consists of one person, despite the fact that the faculty compliment has increased by approximately

one third, and graduate program has more than doubled since that position was established. Additional technical support was one issue raised by the external reviewers for the proposed PhD program.

Recommendation 8: The coop program should be made workable or removed as an option.

At present, the Co-op program is listed in the University Calendar, but it is difficult for students to undertake the required 8 consecutive month work terms due to the nature of offerings of courses in this Department. Many courses (2nd year and above) are only offered once per year, and some only every two years. The Undergraduate Curriculum Committee will consider this recommendation in two respects, firstly to determine what impact, if any, there would be to the students if we remove co-op as an option, or alternatively, to adapt our program to make co-op more viable for students if possible.

Recommendation 9: The Department should consider collaborative programs with other departments in relevant areas and should push to have Earth Sciences courses included as required courses in other programs for example, Environmental Science housed in the Department of Biology to enhance undergraduate enrollment and to integrate the Department into the Faculty of Science.

In addition to developing two streams in Earth Sciences (Geology Stream and Environmental Geoscience Stream), the potential for developing a third, more flexible stream has been discussed by the Department. This third stream could be designed in such a way as to encourage collaborative programs. However, initially, we intend to focus our attention on developing the two streams.

With regard to the second point, the Department has repeatedly, over the years, attempted to encourage the other departments in the Faculty of Science, via the Faculty of Science Undergraduate Curriculum Committee, to recognize that our first year courses are not included in the major program requirements of any other major program. We have got no where on this issue, and consequently, our enrolment in first year is limited to students who take Earth Sciences out of interest or who are intended majors. Perhaps the new breadth requirements will open up some doors in this respect.

Recommendation 10: The two lecturers are key to the survival of this program but they are overworked and face burn out. They need support. There duties need to be structured in such a way that there is time for them to take their full complement of holidays and to prepare materials for instruction.

Burnout of our lecturers is something that the Department does not wish to happen. The workload of the lecturers has been high over the past several years, totaling 6-7 courses per year. This has resulted largely from the overall high historic teaching loads in this Department and the need to offer our 100 level courses in the summer semester when research faculty are in the field. This past fall, the teaching schedule was extended and updated. The schedule takes into account a 1 in 9 teaching relief semester for each lecturer as well as possible study leaves. Thus, roughly on a three year cycle, the lecturers teach 6.5, 4.5 and 5 courses per year, respectively. Teaching relief semesters have been scheduled for the summer semester to allow for summer holidays. In the year that both lecturers teach over the summer, they are scheduled to co-teach both summer courses such that they can alternate in taking summer holidays. In addition, if the Department is given the go-ahead to hire a second technician/lab instructor, this will greatly alleviate the workload of the two lecturers in that they will not have to prepare lab materials for their courses.

Recommendation 11: The Department should continue to support the career fair initiated by the students, and should encourage and support the students, to attend and host WIGUC. The University should provide financial support to the students if they host the conference.

For the past two years, the undergraduate students have organized a career fair in which people from industry have been invited to participate. It is our understanding that the fairs have been beneficial to the students. The Chair's office has been involved in both of those initiatives, and will continue to do so. In addition, Earth Science students have attended the WIGUC, but not in any large way. The Western Inter-University Geological Conference is an annual event aimed at increasing student knowledge in the many branched of geoscience disciplines. Geoscience students attending Universities in British Columbia, Alberta, Saskatchewan, and Manitoba gather every winter to discuss projects, job

opportunities, recent discoveries, and technological advances in our field. The Department will look into how it might assist students in attending this conference.

4. Response to Graduate Program Recommendations

Recommendation 1: A graduate student handbook should be written to give particular advice to Earth Science graduate students. This handbook should highlight program requirements and expectations, funding levels, safety issues in labs and in the field, departmental facilities and available infrastructure, career opportunities and how to access relevant information.

The Department already has some of this information available to graduate students, but not in a cohesive format. We plan to develop a handbook in the near future that will also serve the new PhD program.

Recommendation 2: The use of UBC to provide support to the graduate program is viewed as positive. The University should consider ways of making access to the courses easier. One possible method might be by web cast.

The Western Dean's agreement allows for students to take courses at other BC institutions. Earth Science graduate students have taken advantage of this agreement in a variety of disciplines. The main problem with attending courses at UBC is the relatively long travel time. The Department will consider how to facilitate students taking courses at UBC and vice versa. Faculty who are interested in pursuing this initiative, will be encouraged to provide input.

Recommendation 3: The Department should develop a core of graduate courses that are independent of the undergraduate program to support the new PhD program.

In response to the review of our PhD program, the Graduate Studies committee has been developing a course that will be required by all graduate students. This course will be entitled "Topics in Earth Sciences." The major topics of Earth Sciences discussed within a seminar format. A wide range of general Earth Science topics will be covered to provide breadth to the knowledge of graduate students, especially in areas outside their specific focus of research. Students, instructors and possibly guest speakers will present seminars and lead discussions on specific topics. Extensive reading of both current and classic published literature pertinent to the topics will be expected. Other options for future consideration are "intense" one-credit courses that could be taught over a short period, perhaps by adjuncts. Three such courses would constitute the equivalent of one graduate course, but would have the benefit of alleviating a longer term teaching commitment on the part of any one particular faculty member.

Recommendation 4: The Department must find a means of stabilizing graduate funding and recognize realistic completion times. TA's should be recognized by the Institution as a means of funding graduate students and not just complementing the teaching requirement of the undergraduate program.

Graduate students in Earth Sciences are guaranteed two years of support in the amount of no less than $15,000 per year. A faculty member may augment this amount at his/her discretion depending on the availability of funds. Students are encouraged to complete their M.Sc. thesis within a two year time frame and are only offered TA support past that time if there is a need for additional TAs.

With our low undergraduate enrollments, the Department does not have a large TA budget. Consequently, it has become more and more difficult to find sufficient funds to support graduate students. This problem is exacerbated by generally low NSERC operating funds in the Earth Sciences. Some faculty have actively sought out other funding sources in order to support graduate students without the need to draw on Departmental resources. The distribution of TA support is, as much as possible, equitable among faculty, as are the award of graduate fellowships. However, the process is becoming very competitive. In order for our graduate program to continue to grow, which is anticipated with the upcoming PhD program, faculty have had to accept full responsibility for funding students. The Department can no longer guarantee two full semesters of TA support to each student. On average, with the number of faculty that we have, each faculty

member can expect to receive one to two semesters of TA support in total per year. Without additional sources of funding, this translates to roughly one student per year.

Recommendation 5: The Department should encourage faculty members to apply to NSERC for Industrial Postgraduate Scholarships to help students in research projects where an appropriate private sector partner can be found.

Industry supported student research projects have been undertaken in the past through BC Science Council GREAT scholarships. However, this program has been cancelled. Some research areas in Earth Sciences lend themselves well to industrial collaboration and faculty whose research interests can be met should seek industrial support for their students. The Faculty of Science Grants Facilitator may be a useful resource.

Recommendation 6: Graduate students should be encouraged and supported to present departmental seminars, and to give talks at relevant professional meetings.

The Department has a seminar series that is attended, albeit somewhat poorly, by faculty and graduate students. In the past we have had difficulty scheduling this weekly event due to room availability and conflicting teaching schedules. The new teaching schedules will have the seminar hour blocked off for teaching, if possible, for all faculty. In the past, a few graduate students have given seminars at this weekly event. The new PhD program requires that students deliver two departmental seminars. Outside of the Department, encouragement of graduate students to deliver presentations at professional conferences is largely based on individual faculty encouragement. The Department has a travel fund to support graduate students who give presentations at professional conferences. A one time amount of $100 is offered per student.

Recommendation 7: The student societies could explore opportunities to become student chapters of professional societies.

The Department agrees with this recommendation and will support the graduate students in their initiatives in this respect.

Recommendation 8: Care should be taken by the faculty to ensure that their professional differences with colleagues are not transmitted to the graduate students.

The full department recognizes and shares the concern of the external reviewers, and commits itself to follow the standards of conduct as laid out in university policy A30.01 regarding the ethics and responsibilities of faculty members at SFU.

Recommendation 9: The graduate program will require additional resources, including financial support to students, access to infrastructure, and an increase in the quantity and quality of space if the graduate program is going to grow.

The Department agrees fully with this recommendation. If our graduate program is to continue to thrive, it is critical that we obtain additional financial support, access to infrastructure and an overall increase in the quantity and quality of space. Graduate students are currently housed in make-shift research labs, which are for the most part old classrooms, which are inadequately serviced. Graduate student and faculty research space is separated into several buildings across campus, making collaboration difficult. Our two endowed chairs, and the graduate students and post-doctoral fellows they support do not have research labs. As highlighted by the external review team, the quality and quantity of space in Earth Sciences is extremely poor.

Recommendation 10: The University should provide appropriate office space for graduate students.

We have no office space or common room space for our graduate students. Neither do we have common room space for undergraduates, which was unfortunately not noticed by the review team.

5. Response to the Recommendations Regarding Administrative and Service Issues

Recommendation 1: The Department needs to rewrite/replace or abandon (preferably) the constitution in consultation with the Dean and should examine operations in other departments. Operations should reflect the current reality.

The Chair's office has requested copies of constitutions and operating procedures from other departments in the Faculty of Science. However, we have received responses from all departments that indicate they do not have such a document. The Chair will consult with the Dean to clarify how we might amend our Department Rules and Procedures document, which in its present form largely outlines the committee structure but does not address departmental policies in any substantial way.

Recommendation 2: The Department should develop a strategic plan that guides future hiring and program development. The plan should balance the recruitment of faculty members with that of adequate technical support.

According to the Faculty of Science hiring plan, Earth Sciences is not shown to have any additional faculty or support staff until at least 2010. As a result, the Department has not pursued prioritizing hirings or developing a well-formulated plan for hiring, with the exception that we identified the need for an additional technical support person in our last three year plan. The Department does have an unranked list of new faculty positions including a second hydrogeologist, a second geophysicist, a metamorphic petrologist and a paleontologist.

Recommendation 3: The Department should immediately be given permission to hire a technical support person.

We agree with this recommendation. As suggested by the review team, we may wish to consider tailoring that position to include lab instructor duties as well as providing general technical help.

Recommendation 4: The Department requires additional space and improved quality of space.

We agree most emphatically with this recommendation. See comments under Space.

Recommendation 5: The Department requires improved infrastructure to support the teaching and research programs.

Already addressed above under graduate program.

Recommendation 6: The Department needs to focus on promoting the strengths contained within, both inside and outside the University.

As part of the review exercise, the Department identified three areas in which we find we have expertise. In view of these areas of specialization, the Department will need to work towards formulating a plan for promoting these areas both within and outside the University.

Recommendation 7: Faculty members should endeavor to support the seminar program by attending the seminars regularly.

Already addressed under graduate program.

Recommendation 8: The Department needs to develop a respectful workplace policy and to enforce it.

Addressed under graduate program - recommendation 8.

Recommendation 9: Faculty members should be cognizant of professional responsibilities. These include responsibility to the Chair for notice of absences, discussion with the Chair on occasional alternative arrangements for meeting teaching commitments, respect for the varying intellectual aspirations of colleagues in such a diverse discipline and the need for direct face-to-face communication of problems and issues rather than the circulation of email polemics.

The full department recognizes and shares the concern of the external reviewers, and commits itself to follow the standards of conduct as laid out in university policy A30.02 regarding faculty workload. The University policy A30.03 states "Planned absences from scheduled classes that will not result in class cancellations should be communicated to the Chair/Director or designate, well in advance. Unavoidable class cancellations or changes in time and place of class meetings, or the nature of class activities, should be communicated to students expeditiously. The disposition of course material missed through planned or unavoidable absences should be explained to students clearly." In addition, all faculty will be encouraged to provide the Department with contact information when they are not intending to be on campus so that they might be contacted in cases of emergency.

Recommendation 10: The Department members should interact together more both academically and socially.

We agree with this recommendation and will try to organize more events each year, besides the Christmas party.

Recommendation 11: The Department exists largely as an unsupported orphan in the Faculty of Science and requires a commitment of resources from the Faculty and from the senior administration if it is to be successful and sustainable.

We agree with this recommendation.

External Review
Department of Earth Sciences
Simon Fraser University

Overview

The Department of Earth Sciences at Simon Fraser University underwent an external review on March 24 to 26, 2004. The chair of the External Review Team was Dr. Katherine Bergman (University of Regina) and the members of the team were Dr. Jeremy Hall (Memorial University of Newfoundland) and Dr. Ed Sudicky (University of Waterloo). Dr. Colin Jones (Simon Fraser University) was the internal member of the committee and provided support to the committee. This report and the recommendations contained within are based on the Department's Self Study, the information provided to the team by the University, the site visit and information requested by the team from the Department and the University during the site visit. The report is constructed around the following areas: Undergraduate Program, Graduate Program, Research, Administration and Service, and Major Issue Arising. Within each of these main areas the committee will consider the items of concern expressed by the University, including:

- The Department's current and proposed space allocation
- The level of technical support
- The key research areas and their relationship to the undergraduate and graduate programs
- The proposed changes to the undergraduate major program
- The graduate program and the potential for enhanced collaboration with the University of British Columbia
- Graduate student access to equipment and laboratory facilities

The Department expressed several concerns and requested that the committee also review and comment on these, including:

- The size, structure, breadth, depth, integration and reputation of the graduate and undergraduate programs
- The times to completion and financial support for graduate students
- The impact of undergraduate enrollment levels and management of enrollment levels
- The faculty complement in relation to the Department's responsibilities and workload
- The contributions of faculty members, including the level of external research support
- The effectiveness of the administration of the Department and the complement of support staff
- The adequacy of resources and facilities available to the Department to support the teaching and research enterprise (i.e. library resources, computing resources, space)
- The relationship of the Department to other areas on campus
- The relationship of the Department to the community
- The relationship of the Department with alumni

These specific topics will provide the focus for the report and will be discussed in the context of the four principal areas identified by the External Review Team.

Introduction

The Department of Earth Sciences consists of twelve faculty members, of which one is a Canada Research Chair (Tier 1) and another is an endowed chair. There are two lecturers, one technical support staff and three administrative staff. The Department has successfully recruited an additional faculty member to arrive September 1, 2004 and has nominated an external applicant (female) for a Canada Research Chair (Tier 2). For the 2003/04 academic year the Department's projected enrollment is 610 undergraduate

students of which 43 are expected to be Earth Sciences majors, 31 Masters students, 4 Doctoral students (Special Arrangements) and 3 Postdoctoral Fellows. The limited undergraduate enrollment poses significant challenges for the Department and must be addressed because it drives resource allocation in the University and therefore impacts all other aspects of departmental activity.

The original mandate of the Department when it was established in 1995 was to focus on Environmental Geoscience. A second factor that has had an impact on the direction and focus of the Department was the requirement for professional registration of geoscientists in British Columbia (APEGBC). These two factors have guided recent appointments and the undergraduate curriculum. The current complement of faculty members (including the new appointments) and their identified research areas are consistent with the original mandate of the Department and allow the Department to offer an undergraduate program that permits students to meet the requirements of professional registration in the areas of Geology and Environmental Geoscience. It is important that students meet the requirements of professional registration if they are going to become practitioners in Geoscience.

UNDERGRADUATE PROGRAM

The discipline of Earth Sciences at SFU has grown substantially since its inception as a Program in 1995 and as a Department in 1999. The need to develop a broad program from an initially modest faculty base required faculty to accept heavy teaching loads. Teaching loads in the Department are now at an acceptable level close to the Faculty of Science norms. Available teaching space has grown less quickly and is inadequate for the number of majors and minors now enrolling in the programs. Despite these growing pains, the Department's graduates are in demand. Approximately 25% of Earth Science majors and minors enroll in graduate programs, and two thirds of the majors find employment as geoscientists, predominantly in the environmental area. Undergraduate students enjoy the informal atmosphere of the Department. The Department has adequate structures in place to review teaching performance, curriculum and course offerings. The existing Undergraduate Program is of good quality and the following commentary is intended to provide constructive suggestions on future development and direction of the Earth Sciences undergraduate program.

It is imperative that the undergraduate program produces graduates that are employable in the Earth Sciences sector and that these students are eligible for professional registration in the Province of British Columbia if the Department is going to develop a sustainable Earth Science program. The current complement of faculty and courses allows students to meet the requirements for Provincial Registration in two of the four streams, Environmental Geoscience and Geology. It is important that this option be at a minimum retained in the undergraduate program. Future growth might allow for expansion to the other two streams, Geophysics and Geochemistry. This might be achieved through cooperation with Chemistry and Physics respectively. This expansion to include the other two streams should not come at the expense of the current program.

The number of course offerings and students are consistent with other Earth Sciences Departments of similar size across the country. The Department must ensure that the sequencing of courses and alternation of courses to accommodate the limited student numbers allow a student to complete either of the Earth Science programs in four years if the student is working at full load. Completion times are comparable to other Earth Sciences programs across the country.

The Department should focus attention on new approaches to increasing undergraduate enrollments by expanding course offerings at the first year level to improve recruitment potential. The ability to increase enrollments is also hindered by the availability of only one first year laboratory. To attract students the Department should continue to explore the development of introductory courses that do not require a laboratory. Additionally, the Department should evaluate course pre-requisites to facilitate the transfer of students from other disciplines into the Department, particularly at the second-year level. If the plans for future enrollment growth are realized there will be concerns/pressures on the teaching laboratories related to the senior years even with the additional space in TASC 1. The External Review Team commends and supports the Department in their determination to maintain the field-based, hands on experience. This is an

important aspect of any Earth Science program and is essential for the production of high quality graduates that will ultimately enhance the reputation of the program in the broader Geoscience community.

The proposal of offering two distinct streams reflecting professional accreditation is seen as positive and should be supportable with the current complement of faculty. There is a need to raise the awareness of the Earth Science program at Simon Fraser University to potential students and to the broader Geoscience community. Efforts to bring industry to campus and increase awareness of the program such as the career fair organized by the senior students are commendable and should be supported by the Department and the University.

If the quality of the program is to be sustained then the teaching collections need to be maintained and cared for. This will require additional technical support to the Department. This person could also serve as a dedicated Laboratory Instructor that would be responsible for the maintenance and curation of the collections.

Students should be encouraged to attend and to host, with the support of the Department and the University, the WIUGC Geology conference. The coop program should be made workable or removed as an option. The coop program was not viewed as a career enhancing option from the students' perspective and the absence of students enrolled in the coop program through Earth Sciences reflects the opinion expressed to the External Review Team and provides evidence to support this opinion.

Course offerings and distribution of courses among staff should be reviewed to ensure that all faculty are provided the opportunity to offer senior undergraduate courses, particularly at the 4th year in their area of expertise, relevant to the identified streams and consistent with the undergraduate programs, professional registration and employment opportunities. Course offerings should allow equal opportunity for completion in either stream in a timely manner by students. Faculty should be encouraged to collaborate with colleagues to teach courses without a negative impact on teaching credits.

The Department should consider collaborative programs with other departments in relevant areas and should push to have Earth Sciences courses included as required courses in other programs, for example, Environmental Science housed in the Department of Biology. This will serve to increase enrollment opportunities and to integrate the Department into other programs in Science.

The two lecturers are key to the survival of this program but they are overworked and face burn out. They need support. There duties need to be structured in such a way that there is time for them to take their full complement of holidays and to prepare materials for instruction. More teaching space is required and the quality of the space must be improved to reflect the activities of the classroom. Currently students are unable to access resources (microscopes, computers) because the teaching space is used constantly and the equipment is unavailable.

Recommendations

1. An undergraduate student handbook should be written to give particular advice to Earth Science undergraduate students. This handbook should highlight program requirements and expectations, scholarships available, safety issues in labs and in the field, departmental facilities and available infrastructure, career opportunities and ways to access relevant information.

2. The Department should continue to develop the undergraduate program to allow students' equal opportunity to complete either the Environmental Science or the Geology stream as accredited by APEGBC.

3. The Department must ensure that the sequencing of courses and alternation of courses to accommodate the limited student numbers allow a student to complete either of the Earth Science programs in four years if the student is working at full load.

4. While recognizing the need to limit the number of courses at a senior undergraduate level, the Department might offer, on a trial basis, senior undergraduate courses that give faculty members a greater opportunity to expose students to their areas of interest and expertise.

5. The Department should focus attention on trying alternatives to increase undergraduate enrollments by expanding course offerings at the first year level to improve recruitment potential.

6. The Department should continue to explore the development of introductory courses that do not require a laboratory to attract students and enhance undergraduate enrollment, and by encouraging the transfer of students from other disciplines into the Department at the second-year level who have developed an interest in Earth Sciences.

7. The Department requires additional technical support. This person could also serve as a dedicated Laboratory Instructor who would responsible for the maintenance and curation of the collections used to support the undergraduate programs.

8. The coop program should be made workable or removed as an option.

9. The Department should consider collaborative programs with other departments in relevant areas and should push to have Earth Sciences courses included as required courses in other programs for example, Environmental Science housed in the Department of Biology to enhance undergraduate enrollment and to integrate the Department into the Faculty of Science.

10. The two lecturers are key to the survival of this program but they are overworked and face burn out. They need support. There duties need to be structured in such a way that there is time for them to take their full complement of holidays and to prepare materials for instruction.

11. The Department should continue to support the career fair initiated by the students, and should encourage and support the students, to attend and host WIGUC. The University should provide financial support to the students if they host the conference.

GRADUATE PROGRAM

The graduate program in Earth Sciences at SFU is still developing. The program began in 1996 and currently has 24 students enrolled. A PhD program is in the final stages of approval. This is expected to lead to further increases in graduate enrollment to about 35 to 50 students (~3 students per faculty member). Similar to the undergraduate program, the graduate program has experienced inevitable growing pains, especially for providing space for students and their research materials, access to graduate courses, and adequacy and security of funding. The graduate students felt that in general they have a good experience in the Department, with fewer concerns relative to colleagues in other departments. The majority of postgraduates gain employment in geoscience on completion of their degrees, mostly in the environmental area. The graduate program is good, and the Department has effective mechanisms to evaluate the program and to develop it. The succeeding paragraphs focus on a variety of issues that must be resolved to improve the program further.

The last few years have seen a steady increase of graduate students to an average of 3 students per faculty member. The distribution of students among faculty members is unevenly distributed with the Environmental Stream attracting larger numbers of students. The graduate students are highly supportive of each other but would benefit by closer association between the different programs. The graduate students are currently housed in researcher's laboratories, in many cases under very cramped conditions. The graduate students require office space that is outside of laboratory space.

The completion times for graduate students are consistent with other Earth Sciences programs across the country. The quality of the program and the students is reflected by the success for scholarships. Concerns were raised by the graduate students about the number of graduate courses that were an extension of fourth

year courses. The committee agrees with these concerns particularly in light in the anticipated PhD program. The Department should try to find ways to offer core graduate courses, perhaps based around the three streams identified in the research program. These courses should be independent of the undergraduate program. The use of UBC to provide support to the graduate program is viewed as positive. The University should consider ways of making access to the courses easier. One possible method might be by web cast.

The Department must find a means of stabilizing graduate funding and recognize realistic completion times. TA's should be recognized by the Institution as a means of funding graduate students and not just complementing the teaching requirement of the undergraduate program. The Department should encourage faculty members to apply to NSERC for Industrial Postgraduate Scholarships to help students in research projects where an appropriate private sector partner can be found. Graduate students should be encouraged and supported to present departmental seminars and to give talks at relevant professional meetings. The student societies could explore opportunities to become student chapters of professional societies. Care should be taken by the faculty to ensure that their professional differences with colleagues are not transmitted to the graduate students.

The graduate students and recent alumni were very positive about their experience at SFU and the support that they received from their faculty supervisors. Most students believe that the education they received prepared them to move on to opportunities in industry or at other institutions. A coop graduate program is probably not a high priority at this time. The graduate program will require additional resources, including financial support to students, access to infrastructure, and an increase in the quantity and quality of space if the graduate program is going to grow. Adequate research infrastructure should be readily available to the graduate students to support their research programs. This will become a critical issue for the Department as the PhD program begins. The graduate program and reputation of the Earth Sciences Department are still largely unknown.

Recommendations

1. A graduate student handbook should be written to give particular advice to Earth Science graduate students. This handbook should highlight program requirements and expectations, funding levels, safety issues in labs and in the field, departmental facilities and available infrastructure, career opportunities and how to access relevant information.

2. The use of UBC to provide support to the graduate program is viewed as positive. The University should consider ways of making access to the courses easier. One possible method might be by web cast.

3. The Department should develop a core of graduate courses that are independent of the undergraduate program to support the new PhD program.

4. The Department must find a means of stabilizing graduate funding and recognize realistic completion times. TA's should be recognized by the Institution as a means of funding graduate students and not just complementing the teaching requirement of the undergraduate program.

5. The Department should encourage faculty members to apply to NSERC for Industrial Postgraduate Scholarships to help students in research projects where an appropriate private sector partner can be found.

6. Graduate students should be encouraged and supported to present departmental seminars, and to give talks at relevant professional meetings.

7. The student societies could explore opportunities to become student chapters of professional societies.

8. Care should be taken by the faculty to ensure that their professional differences with colleagues are not transmitted to the graduate students.

9. The graduate program will require additional resources, including financial support to students, access to infrastructure, and an increase in the quantity and quality of space if the graduate program is going to grow.

10. The University should provide appropriate office space for graduate students.

RESEARCH

The research capacity of the Department has grown rapidly and can be expected to continue to grow as the good reputation of this young Department is broadcast externally. The initiation of the PhD program will help further this growth. It is commendable that all eligible faculty members that have had an opportunity to apply to NSERC have Discovery Grants. It is also commendable that given the pressure on the NSERC grant selection committees over the last 10 years to new applicants, the average NSERC Discovery Grant in the Department is close to the National average for Earth Sciences. Does faculty collaboration and interaction provide a stimulating academic environment? To an extent, yes, but it should be recognized that because of the modest size of the faculty complement and the breadth of expertise among them, many of their collaborations are inevitably with colleagues at other institutions. These external collaborations are very successful and an absolute requirement for the pursuit of many areas of Earth Science research that require sophisticated and expensive infrastructure.

The identified research themes are appropriate to the faculty complement and should be sustainable. The principal focus/mandate of the Department should remain as Environmental Geoscience to retain the identity of SFU as distinct from UBC and UVic. The current unifying feature of the Department is the focus on field-based studies. This might be a way of building internal cooperation in the Department around the broad discipline base supported by the Department. The Department has been creative in expanding opportunities in areas outside the Department by pursuing collaborations with UBC, industry and government. These collaborations have allowed the Department to successfully expand the research enterprise beyond the expectations of the original mandate. These areas are highly successful and sustainable under the current arrangements. The researchers should be commended for their creative ways of sustaining and growing the breadth of the Department to allow students to pursue different career options. This breadth provides the potential to develop a well-rounded complement of Geoscience expertise in the Province.

Researchers require adequate space and space of an appropriate type if they are to maintain or grow their research programs. The Department should consider identifying core facilities to support the research enterprise. Earth Sciences should retain research space that is currently allocated to the Department in the basement of the Schrum Building when it moves into TASC 1. Further research development and growth in the Department will require additional space of an appropriate type to house new infrastructure. Money currently available to researchers to purchase new infrastructure should be spent and the University should provide appropriate space to accommodate this infrastructure. There is a solid base of research strength as evidenced by the 100% success rate of faculty members in acquiring NSERC Discovery Grants. The graduate student distribution reflects the original mandate of the Department in Environmental Geoscience. The Department should explore opportunities with industry to provide additional resources to support graduate student research and to increase the awareness in the Geoscience community of the SFU program.

Recommendations

1. Re-evaluate the space allocation to Earth Sciences in light of the growth in the research program. It is important to position the space allocated to the Department close to TASC 1.

2. The Department and University need to provide appropriate support and research space to the CRC and endowed chairs.

3. Further research development and growth in the Department will require additional space of an appropriate type to house new infrastructure. Money available to researchers to purchase new infrastructure should be spent and the University should provide appropriate space to accommodate this infrastructure.

4. The Department should continue to develop existing collaborations and look for new collaborative opportunities.

5. The Department should explore opportunities with industry to provide additional resources to support graduate student research and to increase the awareness in the Geoscience community of the SFU program.

ADMINISTRATIVE AND SERVICE

The Department has well-defined committee structures, rules and procedures, with participation clearly stated and a fair distribution of committee membership responsibilities around Department members. The Department appears to be well administered. Some difficulties were noted, relating to arrival of new graduate students, slowness of the Departmental democratic process and occasional tardy responses from the Dean's office. Department members take a very active role in the dissemination of knowledge. The Department runs a very good seminar program, faculty members and students are very active participants in national and international scientific meetings, and all faculty members contribute to the professional community through involvement in their relevant societies.

Faculty members need to find a positive method of communication and avoid email for expressing concerns or frustrations to each other or to the Chair. Faculty members must ensure that their negative comments either about each other or their different areas of research are not transmitted to the student body at any level. The Department should either abandon or rewrite the constitution that governs departmental activities and decision-making to allow for effective management. This is particularly important given the growth that has occurred in the Department since the document was written. The constitution as it stands prevents positive growth, development and dialogue. The Department needs to develop a respectful workplace policy and to enforce it.

The Department should reaffirm its initial mandate as a field-based Environmental Earth Sciences Department. This should provide the focus for resource allocation, program development and recruitment. The Department then needs to develop a strategic plan for ensuring that this mandate is met and that the programs that are developed meet the requirements for professional registration. This will allow the Department to identify the requirements to develop a successful program. This should include plans for growth and development in the future that will allow the allocation of resources in a collegial manner. This should include a strategy to increase enrollment, provide support to key areas and allow for all members to feel that they are making a meaningful contribution to the Department.

The Department exists largely as an unsupported orphan in the Faculty of Science and requires a commitment of resources from the Faculty and from the senior administration if it is to be successful and sustainable. Many of the problems faced by the Department are not within the Department's authority to address. The Department requires an additional technical support person, space (both new space and space of an appropriate type) and infrastructure. The quality and quantity of space is well below the national average for Earth Sciences departments and is well below the Faculty of Science space allocation for lab-based science.

Recommendations

1. The Department needs to rewrite/replace or abandon (preferably) the constitution in consultation with the Dean and should examine operations in other departments. Operations should reflect the current reality.

2. The Department should develop a strategic plan that guides future hiring and program development. The plan should balance the recruitment of faculty members with that of adequate technical support.

3. The Department should immediately be given permission to hire a technical support person.

4. The Department requires additional space and improved quality of space.

5. The Department requires improved infrastructure to support the teaching and research programs.

6. The Department needs to focus on promoting the strengths contained within, both inside and outside the University.

7. Faculty members should endeavor to support the seminar program by attending the seminars regularly.

8. The Department needs to develop a respectful workplace policy and to enforce it.

9. Faculty members should be cognizant of professional responsibilities. These include responsibility to the Chair for notice of absences, discussion with the Chair on occasional alternative arrangements for meeting teaching commitments, respect for the varying intellectual aspirations of colleagues in such a diverse discipline and the need for direct face-to-face communication of problems and issues rather than the circulation of email polemics.

10. The Department members should interact together more both academically and socially.

11. The Department exists largely as an unsupported orphan in the Faculty of Science and requires a commitment of resources from the Faculty and from the senior administration if it is to be successful and sustainable.

MAJOR ISSUE ARISING: SPACE

The space allocated to the Department of Earth Sciences for both teaching and research is inadequate, in both quality and quantity. It is not conducive to good morale for the majority of the faculty members to be crammed into small offices that have little soundproofing clustered around the administrative center and removed from their labs. The main teaching laboratory is too small for students and is inadequate for storage of teaching collections. There is unlikely to be any improvement in research space after the completion of the TASC 1 building, unless the University changes its current plans (as the Review Team understands them). The somewhat expanded teaching space that will be available with the opening of TASC 1, will allow for increased enrollment in first year laboratory-based courses. However, the extra teaching space will not allow for enough lab space for expansion of 2nd-4th year classes, which should be expected if enrollments to first year courses increase. Let us review each of research space and teaching space in turn.

The Review Team took the following information from the 2002-3 SFU fact book.

Earth Sciences	
Net assignable space for research and academic offices	889 m^2
Total number of graduate students (25) and faculty (11)	36
Research and office area per researcher	25 m^2
Other Faculty of Science lab-based departments (Biological Sciences, Chemistry, Molecular Biology and Biochemistry, Physics)	
Net assignable space for research and academic offices	14850 m^2

Total number of graduate students (277) and faculty (101)	378
Research and office space per researcher	39 m^2

The average for SFU Earth Sciences is 64% of the average for the rest of the SFU Faculty of Science's lab-based departments. The equivalent area in Earth Sciences at Memorial University of Newfoundland is close to the SFU Faculty of Science average for other lab-based departments. Earth scientists need space for analytical equipment, microscopes, rock preparation and rock storage, field equipment, research computers, layout of maps, well logs, seismic profiles, rock core and rock mechanics presses. There is no basis for any *a priori* distinction between the size of research space required for Earth Sciences and that required for any of the other four lab-based disciplines in the Faculty. The Review Team was told that one of the research chair holders in Earth Sciences currently has $100,000 of unspent funding available for equipment purchases because he has no space to put the equipment if he was to purchase it. This is unacceptable!

This desperate state of affairs with respect to space and the tensions that it creates within the Department will continue, unless the senior administration takes bold steps to rectify this gross inequity. Assurances that the problem might be resolved by Earth Sciences space allocated in the new TASC 1 Building due for occupancy in late 2005 seem vacuous. According to information provided to the Review Team, the net areas of TASC 1, 7000 level devoted to Earth Sciences research space can be calculated as total net m^2 (1709) minus student study area (112) minus classrooms (367), equals 1230 m^2. Assuming occupancy Fall 2005 of 36 graduate students and 16 faculty members in Earth Sciences, the space per researcher will be 24 m^2, marginally less than it is now! If the 600 m^2 of space in TASC 2, allocated provisionally for the Centre for Natural Hazard Reduction, were to be added to the Earth Sciences research allocation, this would raise the space per researcher to 35 m^2 still less than, but at least close to, the current Faculty of Science average for other lab-based disciplines.

Resolution of the space issue for Earth Sciences is urgently needed. It impacts current operations and morale, and the potential to recruit top-class researchers. We note that the present plans for the newly nominated Tier II Canada Research Chair are for her to occupy an internal office without any provisions for adequate research space. What message does this send regarding SFU's priorities for its future? While the occupancy of TASC 1 and 2 may ultimately satisfy most needs, something must be done immediately to alleviate the current problems. Following the move to TASC 1 and prior to occupancy of any space in TASC 2, it would be worthwhile allowing Earth Sciences to continue to use space in the so-called 'Dungeon' section of the Physics basement and the current research space in the Schrum Building.

Somewhat similar problems arise with teaching space in Earth Sciences. Currently the space is too small and has insufficient collection storage. There is one small first year laboratory (seating around 20 students), a computer laboratory, and a small layout laboratory. The computer laboratory is frequently used for classes so that student access to the computers is restricted. The first year lab is also used for senior level classes and is in almost continuous use during weekdays. It is not possible to schedule more first year laboratory sections. This is a major barrier to increasing first-year enrollment. The Department must increase its undergraduate enrollments to justify its expanding vision. The Department is already planning its strategy to increase enrollments by the addition of first-year 'breadth' courses, however the regular first year courses will also need to be expanded to meet the expectations of the Department for growth in the number of majors. The current restriction on teaching labs limits this, unless the lab lengths are reduced from 3 hours per week to 1-1.5 hours per week. This is not a desirable solution because practical exercises are the essence of Earth Sciences and this option would compromise the academic integrity of the programs. The limitation in first year also affects enrollment into the Earth Sciences major program since many of the majors students (we learned this from talking with them) only determined to take this path as a consequence of their taking a first year Earth Science course. This is a common finding in Earth Sciences departments' worldwide and probably stems from the lack of adequate promotion of Earth Sciences in the secondary education sector.

Occupancy of the TASC 1 Building will partly solve this teaching space problem. By having a second first year lab, at least a doubling of enrollment is possible in first year without recourse to reducing the hours per

week of lab time. Even with this, any consequent increase in recruitment to Earth Sciences majors might soon be limited by the only marginal increase in space for senior class laboratories in TASC 1.

The Earth Sciences Department has put up with inadequate space with forbearance. However, the University administration should reflect carefully on the potential long-term impact of an irresolute and tardy response to the problem. In considering SFU Earth Sciences as a host for top-class learning and research, potential recruits at all levels--undergraduates, graduates, postdoctoral fellows and faculty members --will allow for early-life teething problems in space, but any lingering sense that this is an enduring problem with no foreseeable solution will have a strong negative impact on the attractiveness of the institution.

Recommendations

1. It is imperative that immediate space pressures are alleviated. The current situation cannot continue until the TASC 1 building is built.

2. Re-evaluate the space allocation in the TASC I building in light of new space opportunities available to Computer Science at the new Surrey campus and declining enrollments in Computer Science.

3. Any new space allocations should be adequately serviced for their intended function (eg., air conditioning for computers).

SUMMARY

The External Review Team was impressed with the progress that the Department of Earth Sciences at Simon Fraser University has made in the short time since its inception. There is a solid foundation of field-based research and teaching in the Environmental Earth Sciences. The Department has been creative in the use and allocation of resources, and collaborations to allow the development and support of a more traditional "(hard) rock" field-based research and teaching program. This provides breadth and depth to the program, while maintaining the original mandate of the Department and retaining the identity of expertise at SFU as distinct from UBC and UVic. The University should be proud of the accomplishments of the Department and should provide the support (especially space) that the Department needs to fulfill its growth expectations and to alleviate growing tension in the Department. The Department needs to take positive steps, especially external to the Department, to ensure its future as a respected member of the Faculty of Science and the University, and, internally, to foster an environment in the Department that respects the breadth of the sub-disciplines represented if the Department is to move forward successfully.

The Review Team would like to thank everyone involved in the process for their support and cooperation throughout this process. We hope that the comments and suggestions that we have made will be taken in a constructive light and will provide useful input to senior administration and the Department as you move forward.

LIST OF RECOMMENDATIONS:

MAJOR ISSUE ARISING: SPACE

1. It is imperative that immediate space pressures are alleviated. The current situation cannot continue until the TASC 1 building is built.

2. Re-evaluate the space allocation in the TASC I building in light of new space opportunities available to Computer Science at the new Surrey campus and declining enrollments in Computer Science.

3. Any new space allocations should be adequately serviced for their intended function (eg., air conditioning for computers).

ADMINISTRATION AND SERVICE

1. The Department needs to rewrite/replace or abandon (preferably) the constitution in consultation with the Dean and should examine operations in other departments. Operations should reflect the current reality.

2. The Department should develop a strategic plan that guides future hiring and program development. The plan should balance the recruitment of faculty members with that of adequate technical support.

3. The Department should immediately be given permission to hire a technical support person.

4. The Department requires additional space and improved quality of space.

5. The Department requires improved infrastructure to support the teaching and research programs.

6. The Department needs to focus on promoting the strengths contained within, both inside and outside the University.

7. Faculty members should endeavor to support the seminar program by attending the seminars regularly.

8. The Department needs to develop a respectful workplace policy and to enforce it.

9. Faculty members should be cognizant of professional responsibilities. These include responsibility to the Chair for notice of absences, discussion with the Chair on occasional alternative arrangements for meeting teaching commitments, respect for the varying intellectual aspirations of colleagues in such a diverse discipline and the need for direct face-to-face communication of problems and issues rather than the circulation of email polemics.

10. The Department members should interact together more both academically and socially.

11. The Department exists largely as an unsupported orphan in the Faculty of Science and requires a commitment of resources from the Faculty and from the senior administration if it is to be successful and sustainable.

RESEARCH

1. Re-evaluate the space allocation to Earth Sciences in light of the growth in the research program. It is important to position the space allocated to the Department close to TASC 1.

2. The Department and University need to provide appropriate support and research space to the CRC and endowed chairs.

3. Further research development and growth in the Department will require additional space of an appropriate type to house new infrastructure. Money available to researchers to purchase new infrastructure should be spent and the University should provide appropriate space to accommodate this infrastructure.

4. The Department should continue to develop existing collaborations and look for new collaborative opportunities.

5. The Department should explore opportunities with industry to provide additional resources to support graduate student research and to increase the awareness in the Geoscience community of the SFU program.

GRADUATE PROGRAM

1. A graduate student handbook should be written to give particular advice to Earth Science graduate students. This handbook should highlight program requirements and expectations, funding levels, safety issues in labs and in the field, departmental facilities and available infrastructure, career opportunities and how to access relevant information.

2. The use of UBC to provide support to the graduate program is viewed as positive. The University should consider ways of making access to the courses easier. One possible method might be by web cast.

3. The Department should develop a core of graduate courses that are independent of the undergraduate program to support the new PhD program.

4. The Department must find a means of stabilizing graduate funding and recognize realistic completion times. TA's should be recognized by the Institution as a means of funding graduate students and not just complementing the teaching requirement of the undergraduate program.

5. The Department should encourage faculty members to apply to NSERC for Industrial Postgraduate Scholarships to help students in research projects where an appropriate private sector partner can be found.

6. Graduate students should be encouraged and supported to present departmental seminars, and to give talks at relevant professional meetings.

7. The student societies could explore opportunities to become student chapters of professional societies.

8. Care should be taken by the faculty to ensure that their professional differences with colleagues are not transmitted to the graduate students.

9. The graduate program will require additional resources, including financial support to students, access to infrastructure, and an increase in the quantity and quality of space if the graduate program is going to grow.

10. The University should provide appropriate office space for graduate students.

UNDERGRADUATE PROGRAM

1. An undergraduate student handbook should be written to give particular advice to Earth Science undergraduate students. This handbook should highlight program requirements and expectations, scholarships available, safety issues in labs and in the field, departmental facilities and available infrastructure, career opportunities and ways to access relevant information.

2. The Department should continue to develop the undergraduate program to allow students' equal opportunity to complete either the Environmental Science or the Geology stream as accredited by APEGBC.

3. The Department must ensure that the sequencing of courses and alternation of courses to accommodate the limited student numbers allow a student to complete either of the Earth Science programs in four years if the student is working at full load.

4. While recognizing the need to limit the number of courses at a senior undergraduate level, the Department might offer, on a trial basis, senior undergraduate courses that give faculty members a greater opportunity to expose students to their areas of interest and expertise.

5. The Department should focus attention on trying alternatives to increase undergraduate enrollments by expanding course offerings at the first year level to improve recruitment potential.

6. The Department should continue to explore the development of introductory courses that do not require a laboratory to attract students and enhance undergraduate enrollment, and by encouraging the transfer of students from other disciplines into the Department at the second-year level who have developed an interest in Earth Sciences.

7. The Department requires additional technical support. This person could also serve as a dedicated Laboratory Instructor who would responsible for the maintenance and curation of the collections used to support the undergraduate programs.

8. The coop program should be made workable or removed as an option.

9. The Department should consider collaborative programs with other departments in relevant areas and should push to have Earth Sciences courses included as required courses in other programs for example, Environmental Science housed in the Department of Biology to enhance undergraduate enrollment and to integrate the Department into the Faculty of Science.

10. The two lecturers are key to the survival of this program but they are overworked and face burn out. They need support. There duties need to be structured in such a way that there is time for them to take their full complement of holidays and to prepare materials for instruction.

11. The Department should continue to support the career fair initiated by the students, and should encourage and support the students, to attend and host WIGUC. The University should provide financial support to the students if they host the conference.