FOR INFORMATION

S.90-26
S.90-27

SIMON FRASER UNIVERSITY

MEMORANDUM

TO: Senate

FROM: Liora Salter
Chair, SCAP

RE: External Reviews of Departments within Faculty of Science

DATE: March 14, 1990

The Senate Committee on Academic Planning, at its meeting of February 28, 1990, approved a set of motions accepting the external review reports of each of:

a) The Department of Mathematics and Statistics (S.90-26)

b) The Department of Physics (S.90-27)

together with the responses from each Department and the Dean of Science. These materials are attached for the information of Senate.

I would also like to inform Senate that the External Review of the Biosciences Department has also been completed and SCAP is awaiting responses from the Department and the Dean of Science. The External Review of the Department of Chemistry has been completed and received by SCAP. This Review will be presented to the next meeting of Senate when the Chair of the Department of Chemistry will be able to attend. In keeping with past practice, each Department is required to provide SCAP with a status report, six months after the reviews are presented to Senate, outlining what steps have been taken to implement the recommendations contained within the review.

SCAP is also currently looking at a draft policy on external reviews which I expect to place on Senate's Agenda for the May meeting.

S.90-26

SFU SIMON FRASER UNIVERSITY
MEMORANDUM

	Date: February 26, 1990
To: L. Salter Acting Vice President Academic	From: N. R. Reilly Acting Chairman Mathematics & Statistics
Subject: Response to Review	

The response of the Department of Mathematics to the External Review Report was given formal approval at the departmental meeting on Monday, 26 February 1990. The first draft of the response had been discussed at the departmental meeting on November 30, 1989 at which it was agreed "that the chairman would write a second draft incorporating most of the written suggestions that he had received, and provide that to the faculty for their final comments before sending it on to the Dean of Science".

Since the review took place, the Department has made good progress on several of the developments discussed in the Report of the Review Committee:

1. The M.Sc. programme in Mathematics Education admitted its first class in September, 1989. The calibre of the 15 students currently in the programme is excellent.

2. The Actuarial Certificate Programme received the approval of Senate in December, 1989 and discussions have already taken place with one local actuarial consulting firm that plans to establish a scholarship related to the programme.

3. A system whereby intended mathematics majors are matched to advisors is being established in order to identify, encourage and guide good students. The undergraduate programme requirements are also under review.

4. A search is currently under way for a director of the Statistical Consulting Service and plans have been put in place to extend the service to the Harbour Centre Campus in the next expansion phase there.

5. Detailed plans for the Institute for Statistics and Data Analysis and the Institute for Applied and Computational Mathematics are currently being drafted.

6. Implementation plans are currently being drafted for the introduction of a structured M.Sc. program in Applied and Computational Mathematics and the revamping of the Ph.D. program.

Norman R. Reilly

N. R. Reilly

cc: Dr. C. Jones, Dean of Science
NRR/ml

SCAP 90-4

SIMON FRASER UNIVERSITY
MEMORANDUM

To: Prof. L. Salter, Acting
V.P. Academic

From: C.H.W. Jones, Dean
Faculty of Science

Subject: **External Review of Mathematics & Statistics**

Date: January 30, 1990

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Please find attached the External Review Report of the Department of Mathematics and Statistics. The report is a model of clarity and brevity, as indeed is the Department's response.

It would be appropriate for me to comment on a number of the major recommendations.

Recommendation 2
The Dean and Chair of the Department should investigate thoroughly the working conditions of the department's lab instructors and take immediate steps to ensure that these individuals have the opportunities for holidays and professional development.

This matter has been discussed with the Chair of Mathematics & Statistics. Several steps have been taken to begin to address the concerns expressed.

i) For 1989-90, the Department of Mathematics & Statistics was allocated an additional 40 B.U. of teaching assistantships to provide some relief to the hard-pressed laboratory instructors. This was equivalent to 1 full T.A. per semester for Fall and Spring to assist the laboratory instructors in their tasks.

ii) An additional laboratory instructor position for Mathematics & Statistics is included in the Faculty three-year budget plan for catch-up and growth.

iii) I have discussed with the Chair the role of the workshops and their staffing by T.A.'s and laboratory instructors. The current mode of operation of the workshops is remarkably manpower intensive and the Department may wish to reconsider whether or not this mode of instruction could be modified to better match the resources available.

Regarding III 5 page 5
Teaching loads in the department are above average for the Faculty of Science but not excessive with respect to other similar departments across Canada. Professors should participate in grading at the lower level.

I was a little surprised by this observation, or at least the comments that teaching loads in Mathematics & Statistics are above the average for the Faculty. The Report does not present any data to support this conclusion.

During 1990, I will undertake a review of all teaching loads in the Faculty of Science to further explore this question.

Recommendation 6
We suggest that the University review its teaching assistant policy since the time spent teaching may be one of the causes of the lengthy completion times for graduate degrees.

A Faculty of Science Task Force was struck in Fall 1989 to review teaching assistant work loads within the Faculty. This is an important issue which has emerged in several recent external reviews and should be addressed directly by the University.

Recommendation 7
The Chair and the Dean of Science should investigate obtaining further university funding for research assistantships for support of graduate students.

Recent Access Funding has led to an increase in the number of graduate stipends and graduate scholarships available across the University. These are the only sources of University support for graduate students other than through the T.A. programme.

Recommendation 8
The Dean of Science should form an ad hoc committee to investigate space problems within the Department and formulate plans for the acquisition of additional space and the detailed design thereof.

The Faculty of Science has a standing committee on space which in Fall 1989 reviewed the overall space allocations and space needs within the Faculty.

In Fall 1989, the Department of Mathematics & Statistics was allocated ca. 2,000 sq. ft. of additional space, as a result of moves associated with completion of the Applied Sciences building. This has helped to alleviate the space problem for workshops and for graduate students.

Since the review a new building initiative has been announced. A new classroom complex, which is scheduled for completion in 1991-92, will be built off Kinesiology and Physics and close to Mathematics & Statistics. This building will provide additional office space for faculty and graduate students in Mathematics & Statistics.

Regarding VIII 1 pp 10-11
Should the Department create officially recognized sub-units (e.g. Applied Math, Statistics,...)? Formation of ad hoc committee.

The Department proposes to bring forward proposals for the establishment of an Institute of Statistics and Data Analysis and an Institute of Applied and Computational Mathematics. I welcome these initiatives.

Regarding VIII 2 pp 11-12
Not in favour of the formation of a faculty of Mathematical Sciences at the present time.

The external reviewers concluded that the Department should not, at the present time, leave the Faculty of Science to establish a Faculty of Mathematics. The Department has accepted that the timing does not appear appropriate for such a move.

The Department has stated that it has been and continues to be a fully participating member of the Faculty of Science and I completely concur with that view.

In summary, I would comment that the Department of Mathematics and Statistics is to be congratulated on the very positive assessment of the Department as a whole and its stature on the national and international scene. As noted in the external review, the Department has a number of outstanding scholars and several areas of significant research strength. The energy and quality of recent new appointees was also noted and this indeed augurs well for the future.

C.H.W. Jones

CHWJ:rh:Encl.

c.c. N. Reilly, Acting Chair
Department of Mathematics & Statistics

A REVIEW OF THE DEPARTMENT OF MATHEMATICS AND STATISTICS

SIMON FRASER UNIVERSITY

MARCH, 1989

I. INTRODUCTION

Early in 1989 the Dean of Science at Simon Fraser University formed an ad hoc committee charged with the task of performing an in depth review of all aspects of the Department of Mathematics and Statistics at the University. The committee consisted of Dr. P.J. Browne, Head, Department of Mathematics and Statistics, University of Calgary as Chairman, Dr. W.S. Edelstein, Department of Mathematics, Illinois Institute of Technology, Dr. J.G. Kalbfleisch, Dean, Faculty of Mathematics, University of Waterloo and Dr. B.L. Funt, Department of Chemistry, Simon Fraser University. On March 13, 14, 15 the committee visited the university and conducted interviews with the President, the Vice-President (Academic), the Vice-President (Research), the Deans of Graduate Studies, Science and Education, the Chairs of the Departments of Mathematics and Statistics, Biosciences, Physics, Chemistry and Computing Sciences, faculty members, laboratory instructors and students. Information and statistical data were made readily available and the committee is more than satisfied that every opportunity to perform a thorough review was provided.

The committee found the department to be a congenial group of academics genuinely interested in and concerned with the well being of their discipline, their students and their university. We understand that from its inception the department has tried to achieve a broad coverage of the mathematical sciences: the committee sympathises with this aim and judges that it has been achieved in large measure. The department has many strong points and accomplishments of which it can be justifiably proud.

II. THE FACULTY

The Department has a number of outstanding scholars recognized on national and international fronts and has several areas of significant research strength. Logic and combinatorics are particularly strong within pure mathematics. In applied mathematics and statistics too, the department has recognizable strength. Overall, we were impressed by the level of research activity and scholarship.

While we found the proportion of faculty members funded by NSERC to be a little low by national standards, those who are supported have good grants many of which are significantly above the national average. We also noted success in Conference, Equipment, Infrastructure and Team grants in addition to the standard NSERC/SSHRC operating grants.

In general the department has a group of faculty whose collective expertise is more than adequate to staff a broadly based undergraduate programme and who can offer graduate supervision in most areas of modern mathematics and statistics. In this sense then we see the fulfillment of the original aim of breadth at both undergraduate and graduate levels. We were impressed by the energy and quality of recent young appointments which augur well for the future. We would encourage the department to continue its philosophy of breadth in future development as chances for hiring new faculty arise through overall university expansion and from vacancies arising from retirements, resignations, etc.

III. THE UNDERGRADUATE PROGRAMME

1. It is natural in a large modern North American university for the Department of Mathematics and Statistics to have a large service component in its undergraduate teaching programme. This reflects the fact that students from many disciplines will require at least introductory mathematics and statistics. In our judgement, the department takes this service role seriously and responsibly and as such is in accord with what we understand to be a university policy to the effect that a given discipline should be taught only by the 'department of the discipline'. The department is thus to be applauded for resisting the spread of (for example) statistics courses and for offering instruction in mathematics and statistics to students from a wide variety of other units.

At the first year level the department has a number of similar courses in calculus designed for various groups of students. This situation is not uncommon among mathematics departments and can be defended pedagogically. Little or no fiscal saving would result from combining these courses into a single offering for the numbers of

students involved would require the scheduling of several parallel sections.

2. We were impressed by the system of 'workshops' associated with introductory courses and particularly by the dedication and enthusiasm of the 'lab instructors' who supervise these classes. The workshops are popular with students and in our judgement offer the required individual instruction to offset the large lecture classes. They are particularly effective in overcoming 'math anxiety' experienced by so many students.

Some hope was expressed that the very best students be identified early in their careers and offered more challenging programmes. The 'honours supplement' for calculus designed and offered by the workshop system is an excellent first step in this direction. We noted also the Putnam competition training sessions. In general we sympathised with the hope and so offer

RECOMMENDATION 1. *The Department should take steps to identify excellent students as early as possible in their programme and offer challenging programmes to them.*

We were concerned about what might be termed as the working conditions of the lab instructors. With the pressure of the timetable of the academic year, these individuals frequently are unable to schedule a full holiday to which they are entitled. They should also have opportunities for professional development, such as attendance at pedagogical meetings, time to assess new texts, teaching software and so on. We judged the service given to the department by these individuals to be outstanding -- they are genuinely committed to having their students learn, understand and appreciate the course material.

RECOMMENDATION 2. *The Dean and Chair of the Department should investigate thoroughly the working conditions of the department's lab instructors and take immediate steps to ensure that these individuals have the opportunities for holidays and professional development.*

In one form or another it is quite likely that more manpower will have to be provided in the workshop system.

3. We were concerned with the large number of courses taught by visitors and sessionals. In particular we noted that the department has had two faculty members on unpaid leave for the last few years. The funds released from the salaries of these individuals are used to hire visitors/sessionals and in general provide more teaching (in terms of courses) than would be provided by the two faculty if they were at home. A quick calculation by the Chair showed this shortfall to be 8 or more courses. On the surface it appears that, to staff its courses, the department has to rely on two regular faculty members being on leave without pay, and this situation seems undesirable.

RECOMMENDATION 3. *The Department should develop a strategy for reducing its dependence on visitors and sessional instructors.*

We also heard concerns that standards and workloads expected of students can vary substantially from year to year when visitors are assigned lower level classes. This is particularly the case when the visitors are not familiar with local conditions. We feel it would be helpful for the Department to produce detailed course syllabuses, including the amount of time to be spent on individual topics, for courses assigned to visitors. It may be possible to appoint a regular Department member to be in charge of a given course so that a visitor assigned this course has a resource person to turn to for guidance.

RECOMMENDATION 4. *The Department should offer detailed guidance to its visitors and sessionals in order to maintain consistency in the quality of instruction and the demands placed upon students.*

4. The committee studied the regulations governing the degree requirements pertaining to the major and honours programmes offered by the department.

We noted that there is a minimum requirement of only one course in linear algebra and we wondered if this were sufficient. We believe that all graduates in mathematics and statistics should have some exposure to

probability and statistics and to computing science; yet it seems that the regulations do not guarantee this. We would suggest that the Department consider developing a common core requirement for the first two years to which additional requirements for the various streams or options could be added in the third and fourth years.

In general we are satisfied that an appropriate spread of courses is available (and taken by most students) to build a well rounded degree: it is mostly the structure of the degree programmes that needs a careful review.

RECOMMENDATION 5. *The Department should conduct a thorough review of the regulations governing its degree programmes with the above points in mind.*

5. We considered teaching loads in the department. In comparison with other science departments they appear above average but not excessive in comparison with other mathematics and statistics departments, especially when we take into account the direct support provided by lab instructors and teaching assistants for large lower level classes. In this connexion we feel that professors should take a more active role in the grading of mid-term tests and final exams at the lower level.

6. We noted the popularity and success of the Co-op programme and offer a suggestion that the department consider a co-op programme in conjunction with the Faculty of Education for the training of mathematics teachers. (The University of Waterloo has such a programme.)

We also noted the offering of courses in actuarial mathematics at the downtown campus. In our opinion this is an area which could develop into a strong and popular programme provided that the department can acquire properly qualified permanent staff in this area.

IV. GRADUATE PROGRAMMES

1. Recent trends in the department have seen enrollment growth in foreign students with the numbers of Canadian students remaining

constant. Of late the foreign students have largely come from one country (PRC). This is a national phenomenon but it does present some possible difficulties connected with the lack of diversity among the foreign students and the necessity of financial support for them. Along with every department in the country, this department should debate whether it wishes to place a limit on this trend.

2. In general, graduate degree programmes seemed sound but we noted the absence of a graduate level course in functional analysis. Such a central area should be offered to graduate students.

3. We examined data concerning the time graduate students require to complete their programmes in the Department. While this time seems average or low by standards at the university, it is high by national standards; e.g. in our experience a student ought to be able to complete an M.Sc. programme within five or six semesters. We wondered whether this long completion time placed the Department (and indeed, the university) at a disadvantage in attracting good Canadian students.

We were also concerned with the work loads required of a graduate student in connection with a teaching assistantship. Again, we are concerned that these local demands may place the department at a disadvantage in attracting good students.

RECOMMENDATION 6. *We suggest that the University review its teaching assistant policy since the time spent teaching may be one of the causes of the lengthy completion times for graduate degrees.*

We note that work loads can increase for a student who is a teaching assistant for several different courses at the same time and we urge

the Chair to bear this in mind when assigning duties to teaching assistants.

Average NSERC grants in mathematics and statistics are much lower than those in the experimental sciences. Thus when many students in those disciplines are supported in the summer from research grants, students in this department must continue with teaching assistantships. We would encourage faculty members to support graduate students from their grants as much as possible and we add

RECOMMENDATION 7. *The Chair and the Dean of Science should investigate obtaining further university funding for research assistantships for support of graduate students.*

At first glance the number of graduate students looks large, but when we consider the average duration of a graduate programme the programme is more in line with national averages.

4. We were impressed with the joint Master's programme offered with the Faculty of Education and we commend the Department for its progress in this important area.

5. We were concerned about the quality of space provided for graduate students. It is reported as poor and scattered about in remote locations. Graduate students need to be part of the Department. We have recommendations on this topic in the next section.

V. DEPARTMENT SPACE AND FACILITIES

1. While the problems with Departmental space may be eased to some extent in the near future, there are several questions needing attention.

(i) The department has no lounge/coffee room where faculty, graduate students and even senior honours students can mingle and interact not only socially but also professionally in a relaxed setting. Many departments regard such a facility as extremely important and its absence here is regrettable.

(ii) Accommodation for graduate students is unsatisfactory both in its quality and location. It is important that these students be brought

into central departmental space in order that they become an integral part of the department's life.

(iii) The space provided for lower level course workshops is inadequate: we also had reports of the air being 'stuffy' leading to less than optimal working conditions for students and instructors.

(iv) The space in which the MacIntosh network is located is not well suited to teaching.

Overall then there are many pressing space problems and we offer

RECOMMENDATION 8. *The Dean of Science should form an ad hoc committee to investigate space problems within the Department and formulate plans for the acquisition of additional space and the detailed design thereof.*

2. We heard concerns from many quarters about the level of computing support for all aspects of the department's activities. There is a need for some computing facilities in the workshops for the purposes of enrichment and demonstration connected with the lower level courses. Concerns were expressed about the lack of support for statistical packages owing to the operating system on the mainframe computer. The availability of properly supported central and local computing facilities is increasingly important for teaching and research in mathematics and statistics.

We noted that while the department does have some computing equipment already, it falls across a spectrum of types and makes and seems to indicate a rather ad hoc development. Accordingly we suggest

RECOMMENDATION 9. *The Department should form a committee to review all aspects of computing support and to develop a plan for the co-ordinated acquisition of further equipment and support.*

VI. OTHER DEPARTMENT ACTIVITIES

1. We were impressed with the work of the department in the general area of high school liaison. Problem sets for schools,

programmes/seminars on campus for teachers and students, the special course MATH 190, the booklet "Mathematicians Work", etc are all indicators of excellence. We urge the Department to continue with its first class efforts in this important area.

2. In comparison with other departments of mathematics and statistics the Department seems to have adequate support/secretarial staff. However we heard concerns about long delays for the production of research manuscripts and the fact that many professors now perform secretarial tasks themselves which they, and we, do not regard as efficient use of faculty time. It seems appropriate that the Chair should prepare a detailed analysis of recent experience concerning the level of secretarial support for submission to the Dean of Science.

3. We applaud the Department's plan to expand the Statistical Consulting Service but we do not support the proposal that the Director's salary include a percentage of the fees received. We feel that this incentive scheme may easily lead to conflicts with academic priorities. Rather we feel the Director should have a fixed salary in accordance with qualifications and expertise. The overall budget of the Consulting Service may well include expectations of external revenue but we feel it important that this be revenue for the Service as a whole thus giving incentive for the Director to ensure that the Service overall survives and flourishes.

We regard it as important that the work of faculty members in connexion with the Consulting Service be regarded as scholarly activity and rewarded as such. Without this attitude and approach there is no incentive for (particularly, junior) faculty members to work on problems generated by the service. For particularly onerous projects it may be necessary to consider some teaching relief for faculty members.

Overall we see the Statistical Consulting service as providing valuable contributions to both the education of graduate students in Statistics and to the broader university community of statistics users.

4. We received some comments expressing disappointment at the level of attendance and support for seminars within the department. There was some hope that a department wide colloquium series would be established with lectures for a general mathematical audience which faculty and graduate students would be encouraged to attend.

VII. FUTURE DEVELOPMENT

1. In terms of appointments of new faculty we support the established priorities of Applied Mathematics and Statistics. Following that we would urge the Department to consider some central core areas of mathematics in accordance with its philosophy of breadth of coverage. Possible areas which ought to be considered are Algebraic Topology, Algebra, Partial Differential Equations, Control Theory: this list is by no means complete.

2. In general we see a need for additional staff particularly to reduce the reliance on visitors mentioned earlier. It is also important that the Department have its appropriate share of future overall university expansion.

We note that the Department does have a planning committee and we regard it as important that an overall development plan be produced. Such a plan should include not only staff but also questions of space, computing support etc. Given that the university anticipates some growth, the production of such a plan should be given the highest priority.

RECOMMENDATION 10. *The Department should produce an overall development plan for submission to the Dean of Science.*

It is our anticipation that the Dean will convey this plan to appropriate university administration officers.

VIII. ADMINISTRATIVE STRUCTURE

1. Within the Department we see the group of statisticians as ready for and wanting official recognition as a sub-unit of the department. We detect no desire to form a separate Department of Statistics. At some stage other groups (e.g. Applied Mathematics) amy also seek recognition. While we would not want to see the Department fragment into a large number of groups, we support the aims of the Statistics group and urge them to develop a detailed proposal for presentation to the Department at large. There are examples (e.g. University of Calgary) where a

large department of mathematics and statistics with officially recognized sub-groups functions successfully.

While the Department does have a long range planning committee we also suggest the formation of an Executive Committee to consider all aspects of the Department's operation and to be advisory to the Chair. Such a committee should be widely representative of the department (and should contain the leader of the Statistics subgroup, if formed). We leave the initiative for acting on this suggestion with the Chair -- but should he decide to go forward we suggest he form a small ad hoc group to develop detailed terms of reference for the executive Committee for presentation to a general department meeting.

2. We turn now to the question of a new Faculty of Mathematical Sciences. While this was merely one point in our overall terms of reference, it was brought forcibly to our attention both in the review document generated by the department and in all of our interviews. Clearly, it is a source of considerable concern with faculty members.

There is no guarantee that the formation of a new faculty would bring extra resources to Mathematics and Statistics. Within the Faculty of Science, we see the department currently being treated on an equal footing with the experimental departments in terms of allocation of funds and resources. We saw no significant evidence of systematic mistreatment over the years of the Department but we do recognize that, as often happens elsewhere, the strengths and academic aims and aspirations of the department have not been fully appreciated or understood by other scientists. The mathematical sciences fall in an intermediate ground between the Arts on the one hand and the Sciences on the other; they have aspects of, and historical roots in, both sides and indeed this is the fundamental strength and attraction of Mathematics and Statistics.

In our opinion, the involvement of Computing Science would be essential in any Faculty of Mathematical Sciences. However we detect a reluctance on the part of Computing Science to participate. They have only recently found their current home, are about to acquire new space, and in general regard such a reorganization as premature. We also considered but rejected the possibility that the Department of

Mathematics and Science move to the Faculty of Applied Science. Philosophically this does not seem appropriate.

We come therefore to the conclusion that, at the present time, it would not be advantageous to either the department or the university, for the department to leave the Faculty of Science. We recognize that the current Dean is anxious to ensure that the department is treated fairly and equitably. We urge him to take all possible steps to make his whole faculty aware of the considerable strengths to be found in Mathematics and Statistics. It is essential in working towards the department feeling wanted in the Faculty of Science, to ensure that it is appreciated and understood by the members of his other departments. We are confident that such steps can and will be taken.

To the Department itself we would say that it is time to put this issue aside and to concentrate on excellence in teaching, research, faculty and university governance, service, high school liaison and so on. The Department is far too good and has far too much to offer to mathematics at large, and to the university, to become preoccupied with this question of administrative location.

The committee extends its thanks to the Dean of Science, the Chair of the department and to all who helped us perform this review. We find the Department to have considerable strengths and potentials and we wish it well in its future development.

DEC 89

Department of Mathematics and Statistics

The Department of Mathematics and Statistics is pleased to present the following response to

"A Review of the Department of Mathematics and Statistics"

performed in March 1989. We respond item-by-item to the various recommendations and comments found in the Review.

The Review Committee (page 1) judges that the department has achieved in large measure a broad coverage of the mathematical sciences. We emphasize that this remains one of the department's main priorities.

> **Recommendation 1:** *The Department should take steps to identify excellent students as early as possible in their programme and offer challenging programmes to them.*

We agree completely and are working through various programmes such as Management and Systems Science, Mathematical Physics, Statistics, Applied Mathematics, Mathematics/Computing Science and, most recently, Actuarial Mathematics to achieve precisely this goal. The Departmental Undergraduate Studies Committee is also engaged in a review of this question with a view to providing more challenging programmes to major and, particularly, honours students.

> **Recommendation 2:** *The Dean and Chair of the Department should investigate thoroughly the working conditions of the department's lab instructors and take immediate steps to ensure that these individuals have the opportunities for holidays and professional development.*

We are in complete agreement with this recommendation and are arranging discussions to see that this is done. It is of immediate importance that we pursue this recommendation. The hiring of an additional Laboratory Instructor would move us well towards a solution of this problem.

> **Recommendation 3** *The Department should develop a strategy for reducing its dependence on visitors and sessional instructors.*

We agree completely with the need to reduce our "dependence" on sessional instructors when this term refers to those who have minimal interaction with the regular faculty, do no research, take no part in seminars, do not supervise graduate students, do not add to SFU's prestige by attending conferences, etc. The question is - how? We can conceive of only two ways: reduce offerings or hire more regular faculty to meet the demand. We (and we hope the university) are not in favour of the first method as this would run contrary to Recommendation 1 and the comments made in III 1 (page 2) regarding the importance of the service aspect of our teaching program. Thus, simply, the problem can only be solved by replacing the teaching being done by such sessionals with teaching by regular research faculty. On the other hand we should continue to encourage "visitors" i.e., research faculty level visitors to our department and maintain ways of funding their visits which may include some involvement in teaching. The reason for this is the research expertise as well as the "world view" of mathematics which they bring to the University. Ideally, such research visitors would only teach upper levels courses, graduate courses or seminars where the regular faculty lack the specific expertise.

> **Recommendation 4:** *The Department should offer detailed guidance to its visitors and sessionals in order to maintain consistency in the quality of instruction and the demands placed upon students.*

Although documentation (including a description of the grading system and the course syllabuses) concerning the teaching of Mathematics and Statistics courses is provided to a visitor or sessional and although the visitor or sessional usually discusses the course with a regular faculty member who has taught the course in the past, we agree that more communication along these lines with the new teacher would be in order. Steps will be taken to this end. For instance, a brief orientation seminar, conducted by the chair and involving other regular faculty as well, will be required of all first time teachers in the department at the beginning of each semester.

> **Recommendation 5:** *The Department should conduct a thorough review of the regulations governing its degree programmes with the above points in mind.*

The department reviewed its program "structure" not long before the review took place in March. The result was that, in view of the wide diversity of subjects which can be pursued in this department, we elected to maintain a maximum of flexibility for students pursuing degrees through the department. However, as a result of this recommendation and as there remains some support for it within the department, we will undertake another review shortly in order to take some steps towards satisfying recommendation 5.

Regarding III 5 (page 5). Summary: *Teaching loads in the department are above average for the Faculty of Science but not excessive with respect to other similar departments across Canada. Professors should participate in grading at the lower level.*

In general, we are not very dissatisfied with teaching loads in the department. However, if we are to be a full participating member of the Faculty of Science we should have teaching loads in line with other members of that faculty. All faculty are expected to participate fully in the evaluation (including grading of exams) of the students in their classes.

Regarding III 6 (page 5). Summary: *Recommend Co-op program for training mathematics teachers (with Faculty of Education). Appreciates actuarial mathematics.*

We would be happy to discuss with the Faculty of Education, a co-op program for potential mathematics teachers. We note the existence of a joint graduate program with the Faculty of Education which leads to a degree of Master of Education in Mathematics Education. The certificate/minor program in Actuarial Mathematics has already been approved by Senate and will begin operation at the Harbour Centre campus immediately.

Regarding IV 1 (page 5). Summary: *High enrolment of visa students in the graduate program.*

We have recently reviewed the admission procedures for graduate students. With the growing reputation of our graduate program, the number of applicants for graduate work has greatly increased of late. We felt that it would be improper to place artificial quotas on any national group. However, we are taking additional steps to ensure that the quality of all admittees is high and also to try to attract strong Canadian candidates to the graduate programs by, for instance, writing to other universities to identify and encourage top Canadian students to do graduate work at SFU.

Regarding IV 2 (page 6). Summary: *No graduate course in functional analysis.*

Although Math 832 (Real Analysis II) contains a significant amount of "functional analysis" material and Math 833 (Real Analysis: Selected Topics) can be offered as a functional analysis course given sufficient demand, we agree with this comment. The lack of a regularly offered

functional analysis course is yet one of many inadequacies which are a direct result of our limited faculty resources.

> **Recommendation 6.** *We suggest that the University review its teaching assistant policy since the time spent teaching may be one of the causes of the lengthy completion times for graduate degrees.*

We agree with a complete university review of TA workloads. A task force is now in place in the Faculty of Science to consider several questions relating to teaching assistantships. Although graduate degree "completion rates" in the Department of Mathematics and Statistics are better than those of most of the other units on campus, we agree that reducing these would be helpful in developing an even stronger graduate program. Indeed, our experience indicates that our TA duties are heavier here than in the typical North American university.

> **Recommendation 7.** *The Chair and the Dean of Science should investigate obtaining further university funding for research assistantships for support of graduate students.*

The department fully agrees with such a step. For the reasons given by the review committee (mainly the lack of flexibility with NSERC funds), it would not be out of line for the department to obtain specially allocated funds for graduate student support.

> **Recommendation 8.** *The Dean of Science should form an ad hoc committee to investigate space problems within the Department and formulate plans for the acquisition of additional space and the detailed design thereof.*

Recent developments indicate that the space problems in Mathematics and Statistics will be relieved (but by no means completely solved) over a period beginning January 1990 and extending for several years. This relief relates to graduate student space, Workshop space, micro computer network (teaching lab) space and, finally, office space. This additional space comes from space made available as a result of the completion of the new Applied Science Building and from new space being built in connection with the Institute of Molecular Biology and Biochemistry. We would greatly welcome an *ad hoc* committee to investigate the requisition of adequate space for the development of the mathematical sciences.

Unfortunately the problem of air quality in the new expanded workshops is not being addressed by the university and we believe it deserves great attention.

We are assured by the founding Head of the Department of Mathematics at SFU that from the very beginning a coffee room for faculty and graduate students was a high priority. Unlike most other departments, we have never had an adequate room in which to informally discuss research and teaching with colleagues, graduate students, and visitors.

> **Recommendation 9.** *The Department should form a committee to review all aspects of computing support and to develop a plan for the co-ordinated acquisition of further equipment and support.*

The department has a computing committee doing what this recommendation suggests. Computing equipment development within the department can be described as in a state of infancy. It has only been four years since we started to acquire any such equipment. Recently research computing in the department received a boost with the acquisition of 12 more SUN workstations. We hope to see continued growth in this area.

We have learned that acquiring computing equipment is one thing, but getting the necessary infrastructure support necessary to maintain the equipment as productive research and teaching tools is quite another thing. We urge the University to develop an enlightened view in providing access to software and *continuing* technical support needed in connection with equipment purchases.

> **Regarding VI 2 (page 9). Summary:** *Support/secretarial staff seems adequate. Long delays in production of research manuscripts.*

We have recently hired another staff person to help relieve some of the support-related problems. Unfortunately, staff salary levels provide a deterrent for hiring technical typists familiar with the text processing capabilities of our new computer equipment. Administrative staffing is under constant review by the departmental assistant and the chair of the department.

> **Regarding VI 3 (page 9). Summary:** *Expanded Statistical Consulting Service applauded. Director should have fixed salary not based on external consulting revenues. Recognition of consulting work performed by faculty.*

The department accepts the views of the review committee regarding the role of the director in the expanded Statistical Consulting Service. We have been searching for a few months for a

director, but as of this writing have not been able to finalize an appointment. As the service develops the exact role the faculty will play in its operation will evolve simultaneously.

Regarding VII 1 (page 10). Summary: *Priorities of Applied Mathematics and Statistics supported. Need for people in "core" areas.*

Since the review, a statistician (September 1, 1989) and an applied mathematician (Summer 1990) have been appointed. However, there has also been a resignation of a senior member in the area of combinatorics. The department is actively pursuing its present priorities and is taking the review committee's reference to holes in certain core areas of mathematics very seriously. Given the expectation of significant enrolment increases at SFU, the need for research capability in several areas as well as the view in Recommendation 3, the department would expect a significant number of new faculty positions to be allocated over the next five years.

Recommendation 10. *The Department should produce an overall development plan for submission to the Dean of Science.*

The department (like all other units at SFU) must periodically develop such plans. One (for 3 years) has recently been submitted to the Dean and a five year plan is under development.

Regarding VIII 1 (pages 10-11). Summary: *Should the Department create officially recognized sub-units (e.g. Applied Math, Statistics, ...)? Formation of ad hoc committee.*

The department is not very keen to see a fragmentation of the department into "officially recognized" subgroups, if by this is meant the further isolation of the individual faculty members from the dean or the vice president academic. As long as we remain a department within the Faculty of Science, such subgroups could result in an administrative nightmare which is surely undesirable. On the other hand, we fully recognize the importance of appropriate recognition being given to certain groups within the department as a vital ingredient to their development. A separate full fledged Department of Statistics (or of Applied Mathematics) is certainly a possible future development and is not opposed by the department in general. We particularly note how statistics has flourished at institutions which have supported the creation of a separate department, e.g., Waterloo, Toronto, Washington, UBC and Manitoba. As a first step we recommend the bringing forth of two proposals, one for the creation of an Institute of Statistics and Data Analysis and another for the creation of an Institute of Applied and Computational Mathematics. The responsibilities of these institutes would be to oversee and develop the

undergraduate, graduate and research programmes in the relevant areas within the department. Ideally, these institutes would be budgeted with respect to some of their activities (e.g. colloquiums, short and long term seminars, visitorships, etc.)

This and several other recommendations of the Review Committee suggests the formation of a committee. We do not agree with the nearly unending formation of new committees.

Finally:

> **Regarding VIII 2 (pages 11-12). Summary:** *Not in favour of the formation of a Faculty of Mathematical Sciences at the present time.*

We believe the review committee misinterpreted the degree to which the department was "preoccupied" with the question of forming a faculty of mathematical sciences. We do not believe any sleep or work was lost by anyone over this question. It was <u>not</u> the only topic of discussion in the corridors of our department.

The formation of such a faculty at Simon Fraser University in the context of modern developments in the mathematical sciences was and is still, in our view, a good idea. No one in this department ever suggested anything other than remaining full, active and loyal members of the Faculty of Science until such a new faculty was actually formed. We were and are now fully participating members of the Faculty of Science.

Unfortunately, it is true as mentioned in the review that the School of Computing Science at present would not wish to join a new Faculty of Mathematical Sciences and that, without the participation of Computing Science, a Faculty of Mathematical Sciences makes much less sense than it otherwise would. SFU is not ready for such a significant development at present. We accept this and will continue to work in our present "administrative location".

General Comment: the department noted that the review committee's report focussed primarily on administrative and curriculum matters and missed the opportunity to make more constructive recommendations regarding our research efforts. In current times, the vital role of Mathematics, "the Queen of the Sciences", to provide necessary resources to a modern day research university is seldom questioned. It is a fact that essential areas of mathematical research have not been adequately supported due to a lack of commitment on the part of the SFU administration, and that this was not mentioned to any significant degree in the departmental reviewers' report.

S.90-27

SIMON FRASER UNIVERSITY
MEMORANDUM

To: Prof. L. Salter,
Acting V.P. Academic

From: C.H.W. Jones, Dean
Faculty of Science

Subject: **Physics External Review**

Date: February 21, 1990

==========

Please find attached the report of the Physics External Review Committee and the Department's response.

This review went remarkably smoothly, in part because several members of the review committee have had considerable experience in conducting reviews of academic departments and of government laboratories. However, it is also appropriate to comment that the Department was very well prepared and, in particular, the planning document and supporting material provided an excellent basis for the review.

The Department of Physics has, over the last 25 years, concentrated its appointments and its research efforts in one area, condensed-matter physics (CMP). The Department has been very successful in this, and the reviewers conclude that the SFU Physics Department is one of the two leading centres in this field in Canada and that it enjoys an excellent international reputation. The reviewers recommend that the present complement of faculty in CMP be maintained.

However, the reviewers also recommend modest expansion of the Department (4 new positions over five years) into a secondary area, that of theoretical particle physics/field theory. This would build on some current expertise in the Department and on the University's strong linkages to TRIUMF. The Department supports this finding.

The committee also recommends, and the Department strongly supports, that every opportunity should be taken to make "pre-emptive" appointments mortgaged against future retirements. This will be required to anticipate the very fierce competition for new faculty over the next 5-10 years, particularly in areas such as CMP where competition with industry is intense.

The report contains a range of constructive and useful recommendations concerning the undergraduate and graduate programmes and the Department will be actively addressing these over the coming months.

C.H.W. Jones.

C. H. W. Jones

CHWJ:pl
Att.
c.c. M. Plischke

SIMON FRASER UNIVERSITY

MEMORANDUM

To: Dr. C.H.W. Jones
Dean of Science

From: Michael Plischke, Chairman
Department of Physics

Subject: PHYSICS DEPARTMENT
EXTERNAL REVIEW

Date: February 19, 1990

I enclose the Physics Department's response to the Report of the External Review Committee. Some of the comments of the Committee deal with the graduate and undergraduate curriculum. These suggestions will be discussed by our departmental graduate and undergraduate curriculum committees and we will respond when their deliberations are concluded. I believe that, in the meantime, the Report and our response can be sent to Senate.

Michael Plischke

MICHAEL PLISCHKE

MP/ML

Enclosure: Report dated Feb. 19/90

PHYSICS DEPARTMENT EXTERNAL REVIEW
February 19, 1990

Response to the report of the Review Committee

The Physics Department Review Committee has presented a thoughtful and perceptive analysis of the department and has made a number of constructive suggestions for future development. Several of the Committee's recommendations deal with the size and breadth of the department. We are in agreement with these recommendations and ask that the following action be taken in order to implement them.

The Committee recognizes that the Department's highly focussed research expertise in condensed matter physics has allowed it to build an international research reputation despite its relatively small size. However, the Department's age profile, in particular in experimental condensed matter physics, has become badly skewed and must be corrected as soon as possible. In view of the importance of this area of physics and in view of the impending shortage of high quality condensed matter experimentalists in the coming decade, we request a second junior position in experimental condensed matter physics at this time and mortages of future replacement positions in each of the next three years. It must be emphasized that in this area of physics we are competing with industry, as well as with other universities, for the best people. For example, two of our top four candidates in the current search had attractive offers from American industrial laboratories.

The Committee also points out that we must now begin to diversify our research and graduate teaching base. Along with condensed matter physics, elementary particle physics is the other main area of frontier research in physics. This is a research area in which we have only one active researcher. As recommended by the Committee, we therefore request the creation of a new senior faculty position in elementary particle/field theory and three junior positions in this area in the next few years. The Committee argues strongly against weakening our existing strength in condensed matter physics and these positions must, therefore, be expansion positions rather than replacement positions.

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We now discuss the Committee's other recommendations.

1. THE UNDERGRADUATE PROGRAM

(a) Integrated 4-semester course sequence

We agree that there are problems in our first year courses (120/121). In particular, most faculty who have taught these courses feel that there is too much material in the syllabus. An integrated four-semester sequence might be pedagogically attractive but could cause new difficulties, in particular for Community College transferees. This will be discussed in depth by the Undergraduate Curriculum Committee during the next few months and we expect to bring forward a proposal for some lower-level course revisions by the summer of 1990.

(b) Methods of Mathematical Physics

Physics 384 (Mathematical Physics) is the single most important requisite for our fourth year physics courses and some of our third year courses. In this course students are introduced to some of the classical methods of applied mathematics in the context of specific physical problems. The aim of this course is to teach the student to integrate the basic tools learned in the prerequisite Mathematics courses and to apply them in a systematic way to physics. We point out that such a course is the rule rather than the exception in North America. In particular, one of the members of the Review Committee (Baker) has been largely responsible for the development of the parallel course at the University of Washington.

(c) Updating of Undergraduate Laboratories

The department has plans to update the undergraduate laboratories and has consistently requested capital funds for this purpose.

(d) Miscellaneous

(i) We agree that rotation of teaching assignments is appropriate.

(ii) All basic courses do have well-defined syllabi. A suitable text will be identified for Phys 384.

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(iii) The Physics Department is responsible for NUSC 485 which is offered every spring. The comment in the review presumably refers to NUSC 442 which was not offered as a regular lecture course in 89-1 when a single student expressed interest. The student took the course as a reading course in Chemistry.

(iv) We do use TRIUMF staff to teach in the department. In particular, in 90-1 Dr. B. Jennings is teaching NUSC 485 (Particle Physics). In 89-1 he taught Phys 425, advanced electromagnetic theory, in which relativity certainly plays a role. Some of our regular faculty also do research with relativistic particles (Boal, Viswanathan) and are more than capable of teaching relativity.

e) Enrollment

Enrollment in our upper-level courses has been growing steadily but, as pointed out by the Review Committee, could be better. We hope that a reorganization of the lower-level curriculum will help to attract more students to the Major and Honors programs.

We will also re-examine our recruitment programs and attempt to make them more effective.

2. THE GRADUATE PROGRAM

1. Breadth of Program

The Committee's recommendations are consistent with concerns raised in the Mission Statement of the department and in the Long Range Planning Document of 1988. We agree that there should be a more extensive set of graduate courses and, with the addition of more faculty, this problem should be solved. If there is a major expansion at TRIUMF if/when KAON is funded, more staff from that institution should become available for special topics courses.

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2. Length of M.Sc. and Ph.D. Programs

Our Graduate Program Committee will examine the requirements for the M.Sc. degree in detail during the next few months. The trend in Canada seems to be toward a streamlining of the M.Sc. program. For example, the University of Toronto and the University of Waterloo both offer non-thesis M.Sc. programs. The University of British Columbia has less stringent research requirements than we do. These will be some of the options that we will consider.

One of the contributing factors to the length of both M.Sc. and Ph.D. programs is, undoubtedly, the heavy teaching load of those students without scholarships. The Faculty of Science Task Force on Teaching Assistants has determined that there is no 'research intensive' Canadian university in which graduate students are allowed to perform as much as 20 hours of work per week. The range in other universities is from six to twelve hours per week and we also must work toward this as a goal, both to remain competitive in the recruitment of students and to make the graduate program more efficient.

3. Relationship of M.Sc. and Ph.D. Program

The suggestion that the procedure of transfering from the M.Sc. to the Ph.D. program be streamlined will be discussed again. The Department recently lowered the requirements for transfer from the M.Sc. to the Ph.D. program and further changes may be appropriate.

3. THE RESEARCH PROGRAM

As Simon Fraser University continues to grow, each department must ask itself whether its size and breadth of research program is appropriate for a 10,000, 15,000 or 20,000 student university. Some departments have attempted to cover most of the sub-disciplines within their area and for them, growth simply means maintaining balance among the different subdisciplines.

The Physics Department, from its beginning, has specialized in only one of the major research subdisciplines of physics. The largest frontier research areas in physics are now condensed matter physics, in which we have considerable strength, and

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elementary particle physics. We have one theorist and one experimentalist (joint appointment with TRIUMF) working in particle physics. We have attempted to maintain a teaching capability in this field through the appointment of Adjunct Professors from TRIUMF, but our research program is small.

The Review Committee has recommended that we select elementary particle/field theory as a new area of research expertise and that we add at least three or four new faculty members in this field. We welcome this recommendation and request that we be given a new senior position in elementary particle or field theory. We expect that this established scientist will build up the research program in this area over the next few years.

4. DEPARTMENT RESOURCES

1. We are well aware of the age distribution of our faculty and, once again, request that a second appointment in condensed matter experiment be made at this time. We note that the second candidate recommended for appointment brings the department expertise in one of the new and exciting areas of condensed matter physics, as recommended by the Review Committee in its assessment of the research program.

While the next few scheduled retirements are entirely in the experimental group, it must also be noted that the age distribution of the condensed matter theory group is also badly skewed. We must work toward the long-term goal of a balanced age distribution in all areas and, after some renewal of the experimental group, will wish to search for junior faculty in condensed matter theory as well.

2. The technical support staff is excellent but too small. Although we have recently added a technician, we still do not have the technical support for the research program that we had in the early years of the previous decade.

3. We have recently hired a full-time Laboratory Instructor, Dr. Neil Alberding, who has as one of his responsibilities, the rejuvenation of the teaching laboratories. With a regular infusion of capital we believe that this task can be accomplished during the next few years.

4. We agree with the Review Committee's comments on start-up funds.

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6. We agree with the Committee's assessment of the laboratory space situation. However, we are confident that two new experimentalists can be accommodated for a short period in the existing space.

5. PLANS AND DIRECTIONS FOR THE FUTURE

We are in full agreement with the point of view expressed in this section of the Review Document, namely that the Department continue to grow and to diversify its research capabilities through additional appointments in elementary particle theory. We also agree fully with the 'strategic recommendation' made by the Committee that we make pre-emptive appointments, mortgaged against future retirements in condensed matter experiment at this time. Because of our high profile in condensed matter physics, we will, at the present time, find it relatively easy to interest outstanding young scientists in a faculty position at SFU. However, if we neglect to begin the renewal of the Department at this time, we will be faced with the prospect of rebuilding in the early years of the next century - a much more difficult and expensive process.

Michael Plischke

MICHAEL PLISCHKE
Chairman
Department of Physics

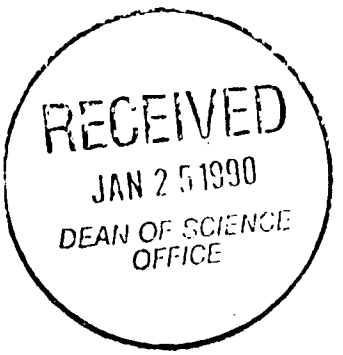
MP/ML

DEPARTMENT OF PHYSICS

University of California
Santa Barbara, California 93106

Telephone: (805) 961-3495

January 18, 1990



Dr. C. H. Jones, Dean of Science
Department of Physics
Simon Fraser University
Burnaby, British Columbia V5A 1S6
Canada

Dear Dean Jones,

On behalf of the Physics Review Committee I am enclosing our report.

We thank you for the excellent arrangements for our visit. It was a pleasure meeting with you and other members of the SFU community. As you will read we have high expectations for the future of this excellent department.

Sincerely Yours,

W. Kohn

Walter Kohn
for the Committee

WK:c
enc.
cc: Academic Vice President, L. Salter

January 18, 1990

Report of the Review Committee
Department of Physics
Simon Fraser University

INTRODUCTION

The review took place December 5–6, the first review–we were told–after more than ten years. The Committee membership consisted of R. Armstrong, Dean of Arts and Sciences and Professor of Physics, University of Toronto (experiments on phase transitions and molecular dynamics); M. Baker, Professor of Physics, University of Washington, Seattle (elementary particle theory); R. Donnelly, Professor of Physics, University of Oregon at Eugene (experimental fluid mechanics, low temperature physics); R. Dynes, Director of Chemical Physics, Bell Laboratories, Murray Hill, N. J. (condensed matter experiment); and W. Kohn, University of California at Santa Barbara (solid state theory, surfaces). Four of the members have Masters' degrees from Canadian Universities. Donnelly and Kohn were originally nuclear physicists.

The Department Chairman, Professor M. Plischke and Dean of Sciences, C. Jones, provided us with excellent descriptive and statistical material

about the background, current status and future plans of the department. By consultation between Dean Jones, Chairman Plischke and the Committee Chair, a very satisfactory agenda was established, including meetings with faculty, students and administrators as well as visits to numerous research and teaching laboratories (Appendix A). A well formulated set of questions (Appendix B) guided our deliberations. We greatly appreciated the friendliness and frankness during our meetings.

We find that the Department has succeeded in establishing itself as one of the leaders in Canadian Condensed Matter Physics (CMP) and enjoys an excellent international name. Although the youngest member of the Department celebrated his 40th birthday during our visit, the spirit of the Department is impressively youthful. All but one member have research grants and/or industrial support. The level of mutual supportiveness in CMP is very high and a major contributor to the Department's excellence. Undergraduates made an outstanding impression on us; graduate students, as a group, somewhat less so. By far the greatest number of faculty and graduate students work in CMP or closely allied areas. There are some problems with several of the $\sim$4 faculty members outside of CMP. We forsee an excellent future for the Department which we expect to remain one of the ornaments of the University.

More detailed analysis and recommendations for the future follow.

I. The Undergraduate Program.

We met with undergraduate students and had a lively and very positive discussion with them. Their morale was excellent. Several students had recently met with students from other Canadian universities and had concluded that their own education was superior. We were struck that all these students came from the Vancouver metropolitan area. They gave two clear reasons for coming to SFU: The wide variety of available Physics majors; and the coop program which offered them industrial experience and the opportunity to earn money. The students identified very positively with SFU and its physics department. Almost all had well thought out plans for their future. We were pleased with the significant percentage of (highly articulate) women students.

When encouraged by us the students also acquainted us with some problems in their curriculum. We took these comments into account in the following assessments and recommendations.

1. The undergraduate program is very thorough and on the whole very well taught. There is convincing evidence that the undergraduate students are very able and received an excellent education.

2. We support the reorganization of the program currently underway in the department, particularly with respect to the first two years. We recommend:

A single, integrated 4-semester course sequence, (including modern physics) during the first two years.

A 2-semester sequence in upper division electricity and magnetism at about the level of Corson and Lorraine.

A 1-semester, upper division course in classical mechanics, including Lagrangian methods and emphasizing applications.

Consideration should be given to having methods of mathematical physics taught by mathematics faculty. (Physics faculty needs to be involved in establishing the syllabus.)

3. The undergraduate laboratory is well organized but needs updating over the next few years.

4. Miscellaneous:

In general courses should not be taught more than 3 years in a row by the same instructor.

All basic courses should have texts and well-defined syllabi.

The nuclear science option is highly regarded. However, problems concerning the availability of one or two low-enrollment courses need attention.

Strong consideration should be given to having relativity taught by TRIUMF staff who do research with relativistic particles.

Concerning enrollment and graduation patterns we offer the following remarks.

5. We consider the present class of ~15 per year too small for the size and quality of the faculty and recommend a target of a 20-30% increase over the next five years. The Department should actively recruit students not only inside but also outside the Metropolitan Vancouver area.

6. The Vice Chancellor expressed concern about non-completion of the major. We have no statistical information about the first two years when many students switch departments. However we were told that ~85% of the students declaring a physics major complete the degree. We consider this very satisfactory.

II. The Graduate Program

The Committee had an extended meeting with about 15-20 graduate students.

We asked them initially why they had come to SFU: the unanimous answer was the CMP program.

We asked them about support. Apparently all students are adequately supported by either teaching appointments, research appointments or combinations of both. Graduate student teaching is governed by union agreement and involves 20 hours/week including preparation. The Committee noted considerable concern about the heaviness of that load: apparently

quite a number spend 4 of their 6 years teaching.

The students, on the whole, believe that the MSc program is a good program but takes too long. Many felt they would like to go directly to the Ph.D. program, which is in principle possible. The minimum GPA for this transfer is 3.67 and permission of the student's committee.

With 20 hours of teaching, the students take only two courses at a time: Quantum Mechanics, Electricity and Magnetism for the first semester, Statistical Mechanics and Solid State 1 for the second semester. For the MSc they need 17 hours which usually includes Solid State II and one other class of choice. For the Ph.D. Quantum Mechanics II, particle physics and a choice of special topics is required.

The students felt that the core graduate courses are well taught, special courses less so. They complained that the choice of courses after the core was too limited. In particular they felt a field theory course should be available, as should group theory from a solid state viewpoint, and non-linear optics.

Students felt their relationships with almost all faculty were good and in fact those relationships constitute one of the motivations to come and stay at SFU.

Every student now gives a 20 minute seminar every year. This program is very popular and useful.

Committee Comments and Recommendations

1. Breadth of Program.

The Committee believes that the curriculum is competently handled, but is, unfortunately, too limited. Theoretical students especially lack sufficient courses to give them the necessary breadth and depth to supplement their research and be adequately prepared for their career. We believe there should be a full year of E & M, and a year of relativistic QM and QFT. Furthermore, there should be more regular offerings of special topics courses such as group theory and nonlinear optics, as mentioned by the students. Special lecture courses by faculty from UBC or staff from TRIUMF would be an important addition to graduate studies at SFU. We recommend that the Department require each student to take 1 or 2 approved courses in an area far from his research. A broad range of graduate course offerings will help significantly in attracting high quality students.

For implications concerning the future size and composition of the faculty, see Section 4 and 5.

2. Length of MSc and Ph.D. Programs

We consider the average times for the completion of the MSc program (~3 years) and the Ph.D. program (~6.2 years) too long for the good of the students. We recommend that normally financial support be limited to 2 years for the MSc degree–or possibly 5–and a total of 6 years for the

Ph.D. degree.

3. Relationship of MSc and Ph.D. Programs.

Strong MSc programs are a prominent feature of Canadian graduate education. Compared to U.S. Master's degrees, which are all too often consolation prizes, the SFU MSc program is a solid program useful to certain students, going on to the Ph.D., and particularly useful for those leaving at the end of the Master's program. MSc theses should however be moderate in scope and length to make possible the shorter completion time for the degree. For students destined for the Ph.D., we consider it important to have a readily available direct access to the PhD program. This will help shortening the average time taken for the Ph.D.

4. Student Recruitment

The merits of the SFU graduate program should be more widely known and an increased effort to recruit, both nationally and internationally (particularly in the US Pacific Northwest), is recommended.

5. Evaluation

In the long run the quality of a graduate program will be reflected by the number of doctoral graduates who obtain positions in leading research institutions and their subsequent careers. Research opportunities in condensed matter physics (especially experiment) are truly outstanding today and the Committee looks forward to seeing SFU graduates playing scien-

tific leadership roles in the future. The enhanced teaching program and new research opportunities afforded by an expanded faculty (see Sec. 5), combined with more vigorous student recruitment, should help achieve this important goal.

III. The Research Programs

1. Overall quality as measured by external research grant support, external recognition and honours, research productivity, etc.

From the Department's beginning the faculty has focused on CMP as area of specialization and this strategy has served them well. While the quality of the individual researchers in CMP varies from world competitive to average, the heavy focus on condensed matter physics and the strong interactions amongst the faculty result in a very strong total program, which gives the university an international reputation: the whole is considerably stronger than the sum of the parts. It should be regarded with pride that all of the condensed matter people have operating grants, with the average well above the national average.

The remaining faculty in other areas of physics, although feeling various degrees of isolation, have also demonstrated strong research programs and are well funded from outside grants.

2. Area of strengths and weaknesses in the research program.

CMP clearly is strong. We do not suggest that the department should

have representation in all areas of physics, but a strengthening through perhaps two new appointments in high energy theory would greatly add to the intellectual breadth of the department.

The directions of research in CMP reflect very much the age distribution of the faculty, where the youngest member is 40 years old. Even in CMP there are current areas of interest which are not represented at Simon Fraser. For example, the whole area of quantum transport and mesoscopic systems is of strong current interest and will continue to be for at least the next five years. CMP is inevitably dependent upon high quality,–well characterized materials. It is, in part, the strength of Simon Fraser that it has strong efforts in synthesis of layered chalcogenides and magnetic systems. Another important area of CMP is semiconductor physics which relies heavily on quality materials. If an appropriate person can be identified, semiconductor film growth (MBE, LPE or MOCVD) would greatly enhance the breadth and productivity of the condensed matter physics people. However, such persons are difficult to find and unless unique circumstances occur which present the opportunity to hire a strong person in this area, this should not be pursued. Compromises should not be made here as a rather substantial investment is necessary for a program of this type. Finally, a carefully chosen experimentalist in the area of macromolecular systems, liquid crystals, polymers, or liquid instabilities would complement the strong theory group in this area.

IV. Department Resources

1. The age profile is badly skewed, the youngest member being 40 years old. Five faculty members, all condensed matter experimentalists, reach the canonical retirement age between 1992 and 1996. This includes A. S. Arrott who holds the largest NSERC operating grant, and has received significant recognition for his research achievements. We were told that the Department presently had one slot for a condensed matter experimentalist; if the opportunity presents itself to make a second appointment we would hope that the Administration would make the necessary resources available. (See end of Section 5.)

2. The administrative and support staff is lean but, from the comments we heard, seems in general to be adequate. Appreciation was expressed for the work done by the common Faculty workshop. It was noted that there are no Departmental charges levied from NSERC grants for technical or workshop support. This is a desirable situation which should be maintained.

3. The undergraduate teaching laboratories are well organized and satisfactory. A recently organized 4th year computer interface laboratory was particularly impressive. However, the equipment is in some cases out of date. A regular infusion of funds for the orderly replacement and upgrading of laboratory equipment is recommended.

4. The equipment available for graduate research and more generally for the research programs of the faculty is of high quality and often state of the art. In particular, the Surface Physics Laboratory is impressive and represents a unique faculty in Canada. However, it will be necessary to provide substantial start-up funds to attract junior faculty. In some cases sums of $300,000 plus may be necessary in the present competitive environment.

5. The computing and library facilities are by and large satisfactory. The proximity of, and access to the more comprehensive UBC library is a definite asset. Certain journal subscriptions cancelled during the period of cutbacks should be reinstated. The mechanics for the purchase of new books appears to be too slow.

6. The laboratory space available to individual faculty appears to be ample. Nonetheless, on the short term, there will be a serious problem if one or more new experimental faculty are recruited before additional space becomes available with the completion of a new building for the biological sciences.

V. Plans and Directions for the Future.

We consider the Department's present very good state to be an excellent base for its future development: The Department has a broad, strongly interrelated high quality set of activities in condensed matter physics (CMP);

an excellent undergraduate student body; and a substantial number of graduate students (we believe of lower quality) and of postdocs and research associates. It has indeed succeeded in establishing itself as one of the two leading Canadian Centers of CMP and has a strong international presence. The present number (~19) of faculty in CMP is comparable with many of the strongest departments in North America and we see no general need for a larger number. Of course special circumstances (e.g. the establishment of an industrially endowed chair) may call for a modest increase. As present CMP faculty retire in the next few years (~5 before 1996), new appointments of young CMP faculty should be made, moving into new areas of opportunity and phasing out some older efforts.

Is continued concentration in CMP wise? We are convinced that it is. The field exhibits an enormous variety and vitality and is the essential base for contemporary high technology. It is intellectually challenging and continues to be the origin of a large fraction of the important new concepts for physics as a whole (collective phenomena, quantum Hall effect, renormalization group, etc.). On the experimental side it offers great scope for physical imagnination and creative instrumentation, of which we saw several important examples at SFU. It will be important, though, for the department to move into new subfields of CMP, as opportunities are perceived.

Given the anticipated future size of the Department, about 26 FTE's

within the next 3-5 years, we consider wide diversification–and the concomitant absence of critical mass in each area–as clearly undesirable. At the same time we believe that an essentially one-dimensional Department (CMP only) is also highly undesirable in depriving both faculty and graduate students of the stimulation and openmindedness provided by more than one scientific perspective. We therefore strongly recommend that the department develop one secondary area which–by making use of some common interests with CMP and with faculty and staff at UBC and TRIUMF;* would effectively have a critical mass. As one promising possibility for this secondary area we propose theoretical particle physics/field theory, an idea which agrees with the present thoughts of several faculty members. Joint appointments with UBC and/or TRIUMF should be seriously considered–they might be very helpful in recruiting. We consider a total of 4-5 SFU FTE's in this area a minimum. The first new appointment should be a senior appointment, the others junior.

As further means for keeping faculty, research staff and students in touch with a broader range of scientific developments we suggest that consideration be given to a regular program of Visiting Professors (in-and outside of CMP), say ~2 semesters per year, who would be asked to give special

* We are aware that a decision on TRIUMF's possible major transformation into a proposed KAON factory is pending. We believe that if it goes ahead it would enormously raise the quality of the overall scientific environment in British Columbia.

courses and seminars.

Finally a very important strategic recommendation: The competition, particularly for good CMP experimentalists, has already become very fierce over the last 3 or 4 years and reliable projections make it next to certain that it will become even much fiercer as the retirement wave grows towards its peak in a few years. Therefore it is essential to make "pre-emptive" appointments now, mortgaged against future retirements. Failure to do so might well endanger the long term future of this Department.

Walter Kohn, Chair
For the Committee

WK:c

Dec. 1, 1989

PHYSICS DEPARTMENT EXTERNAL REVIEW
December 4-7, 1989

ABSOLUTELY FINAL SCHEDULE

Monday, December 4	19:30	DINNER C.H.W. Jones and Review Committee at Hotel
Tuesday, December 5	7:30	Committee, M. Plischke at Hotel
	8:45	L. Salter, C.H.W. Jones (V.P. Academic office)
	9:45	Graduate Students; E.D. Crozier, M. Plischke for Graduate Curr./Admiss. Comm.
	10:35	R.F. Frindt, S.R. Morrison, K. Colbow
	11:25	M. Thewalt
	11:50	LUNCH (P8445)
	13:10	Undergraduate Students; R. Frindt for UGCC (P8445)
	14:05	J.C. Irwin
	14:30	O. Häusser
	15:00	COFFEE, Science Chairs
	15:45	R.H. Enns, K.S. Viswanathan
	16:30	B.P. Clayman, S. Gygax
	17:00	B.P. Clayman (Graduate Studies)
	17:45	Committee meets in camera
	19:00	DINNER (Committee, Plischke, Clayman, Cochran, Colbow, Crozier, Irwin, Rieckhoff, Viswanathan, Wortis at Diamond University Club)
	21:00	Return to Hotel

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All meetings in Physics Seminar Room (P8445) unless indicated otherwise

Wednesday, December 6	9:00	L.E. Ballentine, G. Kirczenow
	9:40	D.H. Boal, M. Plischke, M. Wortis
	10:40	Surface Physics Laboratory (Arrott, Cochran, Curzon, Heinrich)
	12:15	LUNCH (T.W. Calvert, Diamond Univ. Club)
	13:45	Tour of Teaching Laboratories (Frindt)
	14:15	E.D. Crozier
	14:45	K.E. Rieckhoff
	15:10	L.H. Palmer
	15:30	Committee meets in camera
	19:00	DINNER (Committee)
Thursday, December 7		Committee meets at Hotel

All meetings in Physics Seminar Room (P8445) unless indicated otherwise

Physics Review - Terms of Reference

The objective of the review is to provide a critical and constructive analysis of the S.F.U. Department of Physics from the following standpoints:

1. **The Undergraduate Programme**
   a) the appropriateness of the curriculum

   b) the quality of the programme

   c) enrolment patterns and the number of students graduating in Physics.

2. **The Graduate Programme**

   a) requirements for the M.Sc. and Ph.D. degrees

   b) the quality of students who graduate

   c) levels of graduate student support and related matters (e.g. time taken to graduate).

   d) enrolment patterns in the M.Sc. and Ph.D. programmes (Canadian vs. international student enrolments; M.Sc. vs. Ph.D.)

3. **The Research Programmes**

   a) Overall quality of the faculty as measured by external research grant support, external recognition and honours, research productivity, etc.

   b) Areas of strength and weakness in the research programmes
      i) depth versus breadth
      ii) appropriateness or otherwise of current research thrusts.

4. **Department Resources**

   a) Faculty complement; age profile; retirements, etc.

   b) Support staff complement - technical and non-technical

   c) Equipment for undergraduate teaching and graduate teaching and research

   d) Laboratory facilities

   e) Computing and library facilities.

5. **Plans and Directions for the Future**

a) Concentration in condensed matter physics vs. diversification

b) TRIUMF - where does this major facility fit in?

c) Replacement and new appointments - by area

e) The national and international stature of the Department - how best to build on and add to the Department's current status.

Report

A report of 8 to 20 typed pages would be appropriate. The Report should be submitted to the Dean of Science and the Academic Vice-President, who will, following discussion, release it to the Department. The document will then essentially become public. It is current practise for such reports to be submitted to the Senate Committee on Academic planning and to the University Senate itself.