CAIMS/SCMAI Input into the Long Rang Planning Exercise

We have collected a number of points of general interest/concern to the applied math community in Canada as represented by CAIMS/SCMAI. These have been grouped under the following headings: Institutes, DG programme, Other.

Institutes:

(i) Fairness of funding/programme access & distribution from the institutes. There is a perception that a disproportionate share goes to pure math, although this varies between institutes & people asked.

(ii) Similar distribution in terms of leadership of the institutes. Only a few directors (or deputy directors) in the past 15 years have come from an applied math background.

(iii) There should be no restriction on access to support from the institutes to applied math people not funded from the math/stats EGs

There exists a wide spectrum of views as to what could/should be done. These range from maintaining the current structure & ensuring fairness of benefit amongst mathematical disciplines right through to establishment of an “Applied Math Institute”. This is a debate that can evolve over time, should be carried out openly and has no particular urgency. In general CAIMS/SCMAI favours the cohesiveness of the mathematical community as a whole and will work constructively with both the institutes and NSERC to ensure the robustness and dynamism of the Canadian research environment.

DG programme

(i) A large (but unmeasured) proportion of the applied math community does not receive funding from the math EG. This reflects the truly interdisciplinary & unbounded nature of applied math. A constant concern is that these people may be disenfranchised with respect to the math EG/envelope discussion. Some of these people do very well in other EG, but others are discriminated against for being “too mathematical”.

(ii) The issue of interdisciplinarity comes up here. The impression is that the new conference model is handling this significantly better than the old model, but that this is an area that needs constant vigilance and which still has some problems/issues.

- There are some interdisciplinary areas where it is more difficult to identify a clear "home EG" for a math applicant, e.g. scientific computing/numerical analysis, where many of the senior people are funded out of computer science although the research code "numerical analysis" officially belongs to math. Another is financial math, which often ends up in the statistics sub-group even when the applicant's research emphasises numerical algorithms or PDE/SDE.
- Other areas where significant numbers of applied mathematicians may sit more comfortably (but still can suffer the “too mathematical” label) include Ecology and Genetics, Cells & Molecules (where many math biologists sit), Mechanical

Engineering (where math has a significant number of people working in branches of mechanics), and Civil & Industrial Engineering (where the OR community sits, even if OR isn't strongly represented in CAIMS), other branches of Engineering (including areas with control theory, signal processing and imaging).

(iii) There are some concerns about preserving the integrity and robustness of the applied math community in the face of developing disciplines. Many mathematicians at the very applied end fit well into other EG's and compete successfully for large grants, often running large teams. These researchers are going to adapt to new areas as other disciplines expand. At the other end of the spectrum, the pure math community has had (at least under the old model) many well-funded researchers performing at a high level. Between these 2 groups are researchers who may for example provide innovative improvements to mathematical theories that address some of the theoretical issues underlying applications. These people provide a valuable bridge between communities, but may be treated poorly in the evaluation setting, (i.e. its not pure maths, but still far from the application..). This is a point of concern.

(iv) In 2010/11 concerns have been raised within the Math community regarding the DG programme. A focus of many concerns is on the use of HQP as a measure.

- In applied math there is much wider spectrum of HQP than in pure math and so it is harder to establish what a "norm" should be. Researchers with both small and large groups of HQP are doing good work. Therefore, flexibility is needed.
- CAIMS/SCMAI feels that community HQP data (which NSERC certainly has) could be made available to the community, partly so that realistic norms and ranges can be established for evaluation (even outside of NSERC) and partly for individual researchers to benchmark their own contributions.
- Again interdisciplinary issues arise. Whereas within a discipline co-supervision often means each supervisor contributing less than in sole supervision, this is rarely the case when co-supervision is across discipline boundaries. Usually a colleague wants a math co-supervisor because there is significant mathematical content to the research, so this needs careful evaluation.
- Internships should also be counted as HQP.

Regardless of the above items, in general CAIMS/SCMAI members can understand that the federal government wishes to include some metric of HQP training in its decisions on financing of research. We should remain in a constructive dialogue with NSERC as to how an appropriate metric can be agreed on and continually improved.

Other:

(i) Math, as an academic discipline is suffering from an overpopulation of HQP, i.e. globally there are very many more people with PhD and significant numbers of publications who are looking for faculty jobs, than there were 10 years ago. This is a common situation around the world and is true in most other disciplines. This can be

viewed as a success of governmental programmes to increase the numbers of HQP, but it also means that there are not enough opportunities being generated for these people.

(ii) In Canada we are constantly reminded of the above problem, either by the taxi driver with the PhD or by personal knowledge of HQP emigrating in order to find suitable technical professional opportunities. The federal government could improve its efforts to create a more R&D-focused economy (i.e. in private enterprise). It seems in fact that there are numerous funding programmes for industrial collaboration (including those of NSERC) and also many academics willing to collaborate, i.e. the problem is not at the academic or funding agency level. Perhaps NSERC with its academic communities should be collaboratively lobbying for federal attention to be directed towards giving companies reasons to develop their own research cultures. This reluctance to motivate industry directly has been a failing of both Liberal and Conservative governments. The industrial research culture is much weaker than it should be.

(iii) With MPrime coming to an end and with a traditionally poor level of participation in NSERC's RPP's, it would be useful to set up a working group between NSERC and CAIMS/SCMAI to look at mathematical involvement and opportunities in RPP's.

Possibly there are ways that these could be adapted to be more math-friendly while remaining true partnerships. In particular, CRD, Strategic and CREATE are substantial sources of funding that are hard for mathematicians to access. This could be an area that is also worked on with the institutes, for general research directions. Specifically targeted research areas (e.g. Modeling of Disease, Environment and Ecosystem Health) could also be addressed in partnership with other federal and provincial agencies. These methods offer one of the few ways in which we can see an increase in funds, nominally from NSERC, but with much of the increase coming from matching from other organizations.

(iv) Different facets of applied math have emerged and evolved in the past 20+ years: industrial math, math biology (& other medical/life 20+ sciences), math finance, discrete and algorithmic applied math. Other areas such as fluid mechanics, applied mechanics and material science have strong mathematical and societal needs, but the level of mathematics required to make advances is not being taught in regular engineering curricula, so that applied mathematicians are coming to the fore. In many of these areas applied mathematicians are performing in non-mathematical ways: running large projects, interacting with other scientists, etc. Academically there are enormous collaborative opportunities for Math departments in Canadian universities, to participate in interdisciplinary research centres, have cross-appointed faculty, and provide leadership outside of traditional discipline boundaries. NSERC needs to be careful that constructing a "math envelope" does not hinder this.