Submission on behalf of the Australian Council of Deans of Science

Thank you for the opportunity to make a submission to this important enquiry.

The Australian Council of Deans of Science (ACDS) represents the Deans of Science of all Australian Universities. As a group the Deans are integral to the provision of all University teaching and research in the enabling sciences, including Mathematics and Statistics.

The three DEST outcomes below are of vital interest to the ACDS:

Outcome 1: Students acquire high quality foundation skills and learning outcomes from schools,

Outcome 2: Individuals achieve relevant skills and learning outcomes from post-school education and training for work and life,

Outcome 3: Australia has a strong science, research and innovation capacity and is engaged internationally on science, education and training to advance out social development and economic growth.

The charter and publications of the ACDS can be found at http://www.acds.edu.au/
Amongst the publications are several that directly address outcome 3. In particular they demonstrate the serious fall in enrolments in the enabling sciences across Australian Universities. **Science at the Crossroads? A study of trends in university science from Dawkins to now 1989-2002** clearly shows that the science base in Australia is becoming weaker rather than growing stronger. "The science education agenda has broadened over the last 15 years, so that there is now a strong component of science literacy. Many subjects and courses classified as "science" have this character. While this is a welcome development for creating a more science-aware society, these courses are usually not designed to provide the level of scientific skill required for technology invention and innovation. The student enrolments devoted to the innovations end of science represent only a part of the 37% or so increase in general science enrolments, and may well follow more closely those areas like physics, chemistry and mathematics that are in decline. The impact of a decline in basic science enrolments, even relative to enrolments in other disciplines, affects the whole of Australia's innovations effort. ….universities, driven by government policy to be responsive to short term student demand, are shifting resources out of science and technology".

Outcome 1: The ACDS is particularly concerned with the numbers of students coming to University from School especially in the areas of Chemistry and Physics. Anecdotally there is a view that the number of appropriately trained high school teachers in the areas of enabling sciences is insufficient to meet the needs of Australian schools. The ACDS is currently attempting to ascertain the validity of this view by collecting appropriate information. If this proves to be the case it is resulting in insufficient and inadequately trained students presenting for scientifically oriented courses at University. As examples there are fewer students studying Chemistry, Physics and Biology in our schools in 2002 than there were in 1992. (See Science at the Crossroads)

The ACDS is about to release an analysis of school enrolment data that shows that whereas the number of students taking Mathematics in year 12 has increased for both males and females over the period 1998-2002 by 15.7% and 11.1% respectively, nearly 50% of this enrolment is in Elementary Mathematics. In one State, the small growth overall in Mathematics over the period 1998-2002 has seen growth in Elementary Mathematics of approximately 92.6%, and yet growth of Intermediate Mathematics is just 8.2% and of Advanced Mathematics -0.87%. In another (WA), the numbers of students sitting the external examination in Intermediate Mathematics has fallen 5.9% and Advanced Mathematics 6.2% between 2000 and 2003, whilst the number sitting the Elementary Mathematics examination has grown 15.9%

Intermediate, and especially, Advanced Mathematics students are essential for a strong "science, research and innovation capacity". The statistics at hand indicate that numbers in these areas are shrinking and students are instead electing to take Elementary Mathematics.

Outcomes 2 & 3. I confine myself in this submission to funding for higher education and how this impacts on outcomes 2 & 3. I also concentrate on the area of Mathematics and Statistics, although the same points could be extended to cover Physics and Chemistry.

Mathematics and Statistics are important discipline areas for Australia in that they underlie not only the Scientific and Engineering base of the country, but ever increasingly many other areas as well, not the least of which are the Finance and Economics industries.

There have been some exciting and very positive developments in the Mathematical Sciences supported by the Australian Government. I refer specifically to initiatives such as AMSI (The Australian Mathematical Sciences Institute) and the Backing Australia's Ability places aimed at increasing the number of teachers well prepared to teach Mathematics, and the National Centre for Mathematics, Information Technology and Science Teaching based at UNE. Each of these initiatives, and others will assist the Mathematics Sciences, but given the parlous state that Mathematical Sciences has reached in this country it is obvious that further support at the point where Mathematics and Statistics are taught is required.

Mathematics and Statistics at University, are taught to a wide range of students each with different backgrounds and strengths in mathematics arising from their school experience. This diversity requires, in some cases, intensive small group teaching and in most extensive use of computers and sophisticated software. Relative funding models applied to University funding have generally failed to recognize the expense of small group and intensive teaching on the one hand and the increasing need to incorporate computer technology into the subjects taught to students. In many universities, the teaching of Mathematics and Statistics (especially/even in the service areas) requires similar IT infrastructure to that required for Computing. This is definitely not recognized in Government funding strategies.

Research in Mathematics and Statistics in Australia has been extremely strong both in terms of the number of Mathematicians and Statisticians involved in research and of the quality of the research produced. It is true to say that Mathematics and Statistics have suffered greatly as a function of funding changes to Universities. A fair representation of the current situation would be that the quality remains, but is maintained by increasingly smaller groups. This directly relates to the funding level provided.

Demand for Mathematicians and Statisticians – especially those with advanced training – is high. (This is true also for Chemistry and Physics graduates, despite DEST publications suggesting otherwise). Modeling of a great many, if not most, aspects of Australian life (including the environment, mining management, biological management, communication, defence, medical issues, health economics and finance, insurance and business) depend on mathematical and statistical tools, techniques and methodologies, and on research to improve these.

In summary, this submission has concentrated on Mathematics but could equally have focused on Physics or Chemistry.

The points made are:

1. The number of students being trained in schools in Mathematics, Physics and Chemistry at levels that would allow progression into science oriented degrees has fallen significantly over the period 1992-2002.
2. There are some important initiatives now in place to redress the issues in Mathematics. These initiatives will not have an immediate effect, and need to be supplemented by others that will provide returns on a short time-scale.
3. Government funding levels for the teaching of research in Mathematics and Statistics don't cover the actual costs of delivery, and an increase in these could be one means of having an immediate effect on the problems raised above.
4. Research in Mathematics and Statistics is broadly but thinly spread across the University sector in Australia. Appropriate funding that recognized the needs of teaching and research training in these areas could provide more well trained graduates and researchers in Mathematics and Statistics