THE UNIVERSITY OF
NEW SOUTH WALES

23 July 2004

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SUBMISSION ....38.....

Mr Cameron Thompson MP
Joint Standing Committee on the National Capital and External Territories
Department of House of Representatives
Parliament House
CANBERRA ACT 2600
AUSTRALIA

Response to questions posed 23 June 2004

Dear Mr Thompson,

It was a pleasure to address the Committee last month, and I hereby reply to some of the Committee's questions, cunning and informed as they were, that I took on notice.

Is the flattening of the earth at the South and North Poles the same?

The short answer to this question is no, the shape of the Earth differs slightly at the Poles. The "World Geodetic System 1984 Earth Gravity Model 96 (EGM96)" representing the best available data on the figure of the Earth is available at:

`http://earth-info.nga.mil/GandG/wgsegm/`

This model indicates a slight depression towards Antarctica while the North Polar region is somewhat above the global mean level.

As the Chairman stated, the initial definition of the *Mètre des Archives* did not allow for the fact that the Equatorial circumference is greater than the Polar. In 1791 the French Academy of Sciences used an Equator-Pole distance based on an assumed ellipticity of 1/334, and set the length of the metre to be 0·513074 Toise, (a unit introduced by Charlemagne in 790, which was equal to six Pieds

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du Roi or Paris feet). Satellite measures now put the ellipticity at 1/298·26, which means that the metre is 0·2 millimetres shorter than originally intended.

An ellipsoid is a 3D shape formed by rotating an ellipse. A more accurate – and practical - model of the Earth's shape is a geoid, which is a 3D surface representing mean sea level at each point. i.e. the geoid represents the local gravity, as the force of gravity is everywhere perpendicular to the geoid. The geoid is different from an ellipsoid because matter is not distributed uniformly within the Earth, and departs at most by about one hundred metres from an ellipsoid, with greatest deviations being a minimum within the Indian Ocean and a maximum in the North Atlantic. Thus it is perhaps better to talk of the "geoid - ellipsoid separation" rather than flattening at the poles, and the above website provides a calculator to report this separation at any position on Earth.

What is the cost of the sort of infrastructure you are looking at?

We are proposing the **Pathfinder for an International Large Optical Telescope** (PILOT): an optical/infrared telescope with a primary mirror 2m in size. Science drivers, engineering requirements and costings have been considered and discussed by the Australian astronomical community. This projects aims to demonstrate the viability of Antarctic astronomy by way of a small facility that will nevertheless have scientific output equivalent to an 8m telescope costing over ten times as much. The cost of PILOT, including the telescope itself, a winterized enclosure, installation, commissioning and operating costs is AUD$8m. PILOT will deliver world quality science at low cost, thereby demonstrating both the quality of the site and that the technical challenges have been met. The stage will then be set for a larger instrument, delivering performance approaching that of space-based instruments. This future instrument will be of the order of a AUD$100m project, funded and constructed by an international consortium, in which Australia will play a leadership role.

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The existing Dome C infrastructure, already representing over €50m of investment, and intended for winter-over use in 2005, will be used as the basis for logistical support. The proposed AAD airlink provides ideal future access to this site, although without a formal presence at Dome C, Australia risks losing access to this facility.

How much of an advantage does Antarctica provide for these observations over other positions on the Earth's surface?

The Antarctic Plateau provides the best terrestrial sites for infrared and submillimetre astronomy. Many observations can be performed that simply cannot be performed anywhere else on the surface of the Earth. The greater transparency and stability of the atmosphere allow a smaller, cheaper telescope to do the job of larger instrument that was located elsewhere. Other factors, such as the absence of aerosols and extended periods of darkness, provide additional benefits. A great many scientific papers have addressed the detailed implications of these points. These papers can be found at the Joint Australian Centre for Astrophysical Research in Antarctica website:

http://www.phys.unsw.edu.au/jacara/

I firmly believe that now is the right time for Australia to establish a presence on the Antarctic plateau. A number of other countries are poised to build telescopes and other facilities there, having been convinced by Australian research showing the advantages of the site. We have a short window of opportunity - perhaps one year - to capitalize on our location and expertise, and assert an influence, or remain sidelined.

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As a DEST report[1] recently showed, Australian astronomy is the country's most internationally-recognised discipline, producing research cited 42% more than the international average. An investment in Antarctic astronomy will be certain to lead to significant science for many years. This research, together with the presence of a unique instrument, will raise Australia's profile within the Antarctic nations, and provide Australia with leadership opportunities in future projects to be developed within Australian Antarctic Territory. The Prime Minister's Science, Engineering and Innovation Council recently produced a report[2] on Australian Astronomy, with one of its four recommendations being that "Government should specify and support astronomy within the 'agreed priority areas' for the Australian Antarctic Division".

I hope the Committee's evident enthusiasm for astronomy can be realised by supporting Australia's chance to cross one distant frontier in pursuit of another, even more distant and challenging.

Sincerely,

Wilfred Walsh

1 Department of Education, Science and Training 2003 report "Australian Science and Technology at a glance". See chart 42, available at:
http://www.dest.gov.au/science/analysis/pdf/at_a_Glance_2003.pdf

2 http://www.dest.gov.au/science/pmseic/meetings/12thmeeting.htm

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