



BLUESat Project
c/o School of Electrical Engineering and
Telecommunications (G17)
University of New South Wales
NSW 2052 Australia
Ph: (+61) (2) 9385 4498
URL: <http://www.bluesat.unsw.edu.au>

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Committee Secretary
Senate Economics Committee
Department of the Senate
PO Box 6100 Parliament House
Canberra ACT 2600 Australia
economics.sen@aph.gov.au

**RE: Submission for Inquiry into The Current State of Australia's Space Science & Industry Sector –
Further submission from BLUESat**

1. Introduction and scope

Thank you for the opportunity to give verbal evidence before the committee on 1 August 2008. This additional submission addresses two areas which were touched on in our verbal evidence but were not able to be fully dealt with at the time. The two areas are:

- Australian universities which offer space-related degrees; and
- Australian satellites and their effect on space junk.

2. Universities which offer space related degrees

During the committee's enquiry, submissions have estimated the number of space related degrees at about fifteen. In our opinion, the number of Australian universities which offer degrees fundamentally related to space science and space engineering is much smaller. We agree that there are about fifteen degrees that are space related, however we think that only two are "space engineering" degrees, in that a top graduate could find work designing and building satellites or other space objects.

The two universities in Australia which come closest to offering true space engineering degrees are the University of Sydney and the University of Queensland.

The difference in the estimation of the numbers of degrees arises from two factors:

- whether science degrees with an astrophysics major are counted as "space degrees"; and
- whether aeronautical engineering degrees which offer one or two space elective subjects in final year are counted as "space degrees".

In our view, neither of these types of degree are fully fledged space engineering degrees.

The astrophysics major enables people to participate in particular areas of space science, for example designing research experiments to fly on satellites. However, the principal focus of these degrees is to encourage people towards a career in astronomy or physics research.

The space electives in an aeronautical engineering degree are largely in the syllabus to interest and excite students, rather than comprehensively preparing students for a space engineering career. We say this because such a degree only touches on limited aspects of the body of work covered in a pure space engineering degree. Aeronautical engineering degrees differ from “space engineering” degrees because they focus on aircraft rather than space objects. A true “space engineering” degree would focus on some or all of the following components:

- Orbital mechanics (how satellites orbit the earth);
- Launch vehicles (rockets and other methods for getting into space);
- Propulsion systems (powering space objects and launch vehicles);
- Satellite system componentry (which includes facets of telecommunications, electrical and computer engineering); and
- Space environment and testing (designing objects to survive in a space environment).

Often two or three introductory level subjects covering each of these broad areas is offered in the final year. While this gives students a taste of space engineering, such a course is limited in time and cannot cover the subjects in the same depth as a specialised, four year space engineering course. The exceptions, as noted are the degrees at the University of Sydney and the University of Queensland which do cover many of these topics throughout the degree.

In short, these degrees are not geared towards preparing people to work on space projects straight out of university. Understandably, the degrees focus on areas where graduates are likely to find work – in research astronomy and aeronautical engineering respectively.

Most of the students who work on BLUEsat come from engineering degrees – mechanical, electrical, aeronautical and computer engineering are the best represented. On one view, this suggests that it is not accurate to include the astrophysics degrees in assessing Australian degrees which would prepare students for a career building and launching space objects.

Without a significant space engineering industry in Australia, we do not see a need for an expansion in the number of space engineering degrees. However, in formulating industry policy here in Australia, it would be a mistake to think that we have fifteen universities preparing graduates who are ready to perform space engineering. The figure is closer to two.

3. Australian satellites and space junk

During BLUEsat’s verbal evidence, the issue of “space junk” was raised. The cluttering of space around earth with useless objects which pose a collision risk to useful objects in space is a real danger. Any space program which Australia supports should encourage the engineers to have due regard for the function of the object at the end of its useful life.

This could be easily done, for example by mandating that a pass / fail criterion for granting the licence to launch the space object is whether adequate measures are in place to minimise the space junk created from the object during its life (for example solids ejected from the object during its operation) and at the end of life.

As an example of how this is already being put into practice, Anthony Belo from Optus Satellite presented at the Australian Space Development Conference on methods which Optus is using to lift its satellites out of crowded orbits at the end of their useful lives.

A second example is BLUEsat, which will be placed in an orbit in which it will re-enter the atmosphere and disintegrate over a relatively short time period (between one hundred and two hundred years).

4. Summary

We have made two additional points in this submission.

First, be careful in assessing space-related degrees and consider what the degrees equip graduates to do. The majority of space-related degrees in Australia are not comprehensive space engineering degrees.

Secondly, although space junk is a real danger, there is no reason that this should prevent Australia launching satellites.

We look forward to reading the Committee's final report.

Principal Contact

Christopher Walsh

President
chrisw@bluesat.unsw.edu.au

Authors

Anthony Wicht

Visiting Fellow
awicht@bluesat.unsw.edu.au

Christopher Hales

Visiting Fellow
chales@bluesat.unsw.edu.au