

Aspiring Beyond UNSW: Connecting Students to Industry

Craig Roberts

School of Civil & Environmental Engineering, University of New South Wales
c.roberts@unsw.edu.au

ABSTRACT

The recent BIS Schrapnel report commissioned by the Association of Consulting Surveyors highlighted the growing demand for graduate surveyors in New South Wales and across Australia. The former School of Surveying and Geospatial Engineering (SAGE) at the University of New South Wales (UNSW) was merged with the School of Civil and Environmental Engineering (CVEN) in 2013 and is now a group within the largest school at UNSW. The cohort of students studying surveying remains small, but the merger presents great opportunities for civil engineering students to be attracted into the surveying program. Because of the smaller class sizes, surveying students are exposed to many more hands-on exercises in the field and the lab as well as extracurricular activities in partnership with their own student society SurvSoc and the Institution of Surveyors NSW, Young Surveyors and Cumberland groups. All students are required to undertake at least 60 days of industrial training as part of their studies and some companies even suggest final year thesis projects to complete in partnership with academics at the School as a way of keeping bright students after graduation. UNSW was recently ranked 46th on the QS World University rankings with the School achieving a rank of 14 compared with other Civil schools globally. The ATAR score is the highest of any surveying program offered in Australia, which has the benefit of attracting the highest potential students into the programs. The school has recently purchased a suite of new GNSS receivers, a laser scanner, six UAVs, and an assortment of enabling software. All of these attributes provide fertile ground for a new generation of modern Surveying and Geospatial Engineering graduates. This paper details how these opportunities are being exploited and provides some examples of recent work conducted by our undergraduate students.

KEYWORDS: UNSW, industry, students, industrial training, young surveyors.

1 INTRODUCTION

Since its establishment in 1949 as the then University of Technology, the University of New South Wales (UNSW) has produced over 1,500 graduate surveyors (Loeffel, 2007). Many have gone on to become registered surveyors in NSW, directors of their own businesses, GIS professionals, leaders in government (local, state and federal) and influential academics. In recent times the landscape of higher education has evolved in Australia.

Universities are increasingly seeing the value in improving their international rankings to attract the best students (especially international students), the best staff and research funding. The QS rankings (QS, 2016) compare the world's top 800 universities using indicators such as academic and employer reputation, staff-student ratios, research citations and the proportion of international staff and students. As a university, UNSW ranks 46th in the world in the 2015-16 league table (up two places from last year). UNSW enjoys an enviable

employer reputation, ranking 22nd in the world, and 42nd for academic reputation. In the 'Engineering and Technology' category (where Surveying and Geospatial Engineering, SAGE, resides), UNSW Engineering has further strengthened its position to 21st (up 6 places) in the 2015/2016 QS World University Rankings.

These rankings bring prestige to the institution, but it should be noted that rankings are highly valued by international students deciding where to study. Domestic students will tend to study at their local university and not travel, however marketing at the Faculty of Engineering is increasingly trading on rankings for domestic students as well.

This change in landscape can be of great benefit to the surveying profession if members are willing to embrace this new paradigm. For surveying graduates from UNSW, their stocks are rising which could have extra value if working overseas, especially when dealing with international graduates from UNSW. Given this background, this paper seeks to offer suggestions on how the surveying profession can better engage with UNSW staff and students to exploit the combination of a high ranking institution, students with high potential and the many new geospatial technologies that can open new applications requiring SAGE expertise.

2 ENGAGING WITH STUDENTS

2.1 The School of CVEN

The merger of the former School of Surveying and Geospatial Engineering (SAGE) with the School of Civil and Environmental Engineering (CVEN) in 2013 presents many opportunities. CVEN is the largest school in the University, currently with over 2,500 students and staff. All year cohorts of the undergraduate Civil Engineering degree program comprise 300-400 students compared with around 15 undergraduate Surveying students per year.

Since joining the new school, the Bachelor of Engineering BE (Surveying) and BE (Geospatial) programs have been streamlined to better align with the BE (Civil) program. These new streamlined courses began in 2015 for both first and second year students. During this process, 12 core SAGE courses were identified as necessary to qualify graduates as potential candidates for registration in NSW as land or mining surveyors and/or to be well prepared as future geospatial engineers. Additionally some of the common CVEN core courses were chosen to support the registration requirements such as water engineering, transport and highway engineering and project management. The great advantage of this new streamlined course is that it enables CVEN students considering changing into SAGE an easier transition.

Further to this new streamlined BE (Surveying), a new dual award program in Civil and Surveying has been approved and will be offered in 2016. This will be a BE (Civil) / Bachelor of Surveying (CVEN, 2016a) and will require 5 years for completion. Graduates of this new program will be accredited as civil engineers by Engineers Australia and the Board of Surveying and Spatial Information (BOSSI) NSW for registration as land or mining surveyors in NSW.

This dual award program was prepared prior to the UNSW Courses and Careers Day, 5 September 2015, and considerable interest was generated by students on this day. Academics

and office staff are receiving numerous enquiries from students within the School wishing to change programs to either the new streamlined BE (Surveying) program or the dual degree.

2.2 Industrial Training

An opportunity for the profession to assist with marketing these new course offerings is through industrial training. All students studying engineering are required to undertake 60 days of industrial training. Surveying students have never had a problem acquiring this work experience. However, due to the large numbers of students enrolled in Civil Engineering programs, it is often difficult for Civil students to find appropriate experience with over 2/3 reporting that they do not get paid for their work experience obligations. This presents a terrific opportunity for the surveying profession. Often Civil students have little knowledge of the tasks of a surveyor as they are no longer *required* to take a first-year elective surveying course. Nevertheless, members of the profession could offer surveying work experience over the summer to Surveying or Civil Engineering undergraduate students as a way of introducing them to the discipline of surveying. If they enjoy the work, it will be much easier for them to change courses at UNSW into the new streamlined courses.

2.3 Final Year Thesis Projects

Final year students are required to undertake a thesis project (also called an honours thesis), which comprises a total of around 300 hours work (2 x 6 unit of credit courses \approx 150 hrs each). Usually academics devise thesis projects in their existing research area or in a new research area of their interest and place on the school intranet for students to choose. These topic areas are organised on the school intranet site under the following categories which mirror the various groupings within the School:

- Engineering and Construction Management.
- Environmental Engineering.
- Geotechnical Engineering.
- Structural Engineering.
- Transport Engineering.
- Water Engineering.
- Surveying and Geospatial Engineering.

Sometimes students with a particular interest may devise their own thesis project but they must find an academic willing to supervise their work. Also with the new dual program about to commence in 2016, there is even more scope for thesis projects that straddle a few discipline areas.

Final year thesis projects offer a great opportunity for industry engagement with the School. Surveyors (government or private) with a particular interest in a topic could devise a project in partnership with academics in the School and hopefully attract a bright student to undertake research into this topic at no cost. Academics can assist with writing the project (only about half a page) and place on the School's intranet site. It is best when a supervisor from the government or private organisation agrees to assist with the supervision. Perhaps a new piece of equipment or software has been purchased, or perhaps the organisation is already undergoing a task and would like to investigate an aspect of this but simply does not have time. A thesis student will have the time to devote to a project and, with some guidance, may discover interesting aspects about the project risk-free and at no cost.

Industry-style thesis projects are often favoured by students and present a great opportunity for better industry engagement between the profession and the School and could potentially provide a graduate student to the organisation. It should be pointed out that SAGE academics also have access to Computer Science, Electrical Engineering and Mechanical Engineering students in case the topic of interest is outside of the discipline of Surveying or on the fringes of Geospatial Engineering. Members of the profession are encouraged to correspond with academics in SAGE regarding their project ideas.

An example of a new project description is given here:

Georeferencing in a Dynamic World

How well is Google Earth georeferenced? Handheld GNSS gives about 5 m accuracy. The latest Google Earth (GE) images (using aerial photography) have a resolution of better than 10 cm for each pixel in the city. How well are these positions georeferenced on the ground? How does GE do it? Is it orthophoto standard? This project will investigate some areas within Sydney (and beyond where applicable) to determine the quality of georeferencing of the images. Further this project will have to contend with next-generation datums. GE uses WGS84. How are the images georeferenced at the epoch of capture? Australia moves NE at ~7 cm/yr. That is almost one pixel per year? What about other mapping applications on phones and other devices. How will they deal with next-generation datums if they can position in real time at the decimetre level?

The outcome of this thesis project is not clear. The student will liaise with his/her supervisor as they learn more and the project will evolve. Often this is all that is required for a good thesis project description. A good idea with an achievable goal is all that is required for an interesting thesis project. However, not all projects are selected by students.

Some examples of recent student thesis projects include:

- Coordinated cadastre: Putting the puzzle back together.
- Performance testing of robotic total stations for real time tracking applications.
- Factors affecting quality of photogrammetric mapping with small unmanned air systems – *winner of EISSI University Student Prize 2015*.
- Computer vision-based traffic flow analysis.
- A modern multi-function map for Cataract Park.
- BeiDou performance within a multi-constellation continuously operating receiver system.

Since merging with the new School of CVEN, the SAGE group has been fortunate to purchase a range of new equipment including new Leica Viva GNSS now equipped to measure the Chinese BeiDou constellation, a Leica C5 laser scanner, a Trimble R1 sub-metre DGPS system and six UAVs across the School as well as a range of supporting and stand-alone software. All this equipment can be used for thesis projects and there is usually budget for minor purchases to support thesis research activities.

2.4 Awards

Student thesis projects are also eligible for the Excellence in Surveying and Spatial Information (EISSI) Awards, University Student Project prize category. If an organisation is associated with the award, they too receive some kudos (CVEN, 2016b). Alternatively, the thesis project could be rewritten as a conference paper such as Allerton et al. (2015), which won the best research paper award at the recent SSSI Locate'15 conference. Another example is Roberts and Boorer (2015), which has been published in the Journal of Spatial Science.

2.5 SurvSoc

The student society SurvSoc is a ‘sandpit’ for future leaders and contributors to the profession. SurvSoc has structure, with a committee comprising a president, vice president, treasurer, secretary, ARC delegate (on-campus societies), industry (ISNSW Cumberland group) and year representatives. They hold regular meetings with minutes and they organise events such as BBQs and sporting activities amongst themselves and with other student societies. Earlier this year, in association with ISNSW and especially the Young Surveyors group, SurvSoc held a small seminar with some invited speakers to learn about registration as a surveyor in NSW. All these activities are excellent training for their future professional careers and provide great opportunities for engagement with the wider industry. They must also negotiate a co-habitual arrangement with the larger Civil and Environmental Engineering society (CevSoc) within the same school (CVEN, 2016c).

3 WIDER INDUSTRY ENGAGEMENT

3.1 Research Partnerships

A further extension of a final year undergraduate student thesis project could be for a research partnership to commit funds and staff time towards a more ambitious research program. This is best done under the Australian Research Council (ARC). The ARC is an Australian Government Commonwealth entity. Its mission is to deliver policy and programmes that advance Australian research and innovation globally and benefit the community (ARC, 2016). The ARC offers a number of competitive grant schemes but perhaps the most appropriate is the ARC Linkage scheme. Linkage promotes national and international research partnerships between researchers and business, industry, community organisations and other publicly funded research agencies. Academics look for partnerships with such organisations and write an extensive research proposal detailing the intended research outcomes, budget and resources required. The best possible outcome could see a research partner receive \$4 from the ARC for every \$1 of cash they invest into the project. This money then funds either a scholarship for a PhD student (or several), or a post-doctoral researcher who will be dedicated to the project and some travel and equipment money to support the research. This is a major undertaking and there are no guarantees of receiving funding, however, in recent times UNSW has been one of the most successful institutions for ARC Linkage grant applications. Also it should be noted that unsuccessful but strong applications may receive internal university or faculty funding.

3.2 Industry Projects

Sometimes larger government organisations have ongoing projects which require manpower and do not necessarily have a definitive timeline. An example might be the Land and Property Information (LPI) update of survey control using AUSPOS or RTK updates of the Digital cadastral database (DCDB) in rural townships. With some creative thinking, perhaps there is scope for better partnerships between government and the university by devising a mutually beneficial student project that could undertake these ongoing tasks as part of an assessable course. Issues such as Work Health and Safety (WHS) and professional indemnity can be covered by the university. The quality of the data acquisition would have to be assured before it is used for public consumption.

3.3 Industry Partners Program

In order to assist with the funding of School based marketing activities, the Industry Partners Program (CVEN, 2016d) was set up to request sponsorship from civil engineering and now surveying companies. This money is used to support such activities as the annual ‘bus tour’ whereby 60 students from 60 different high schools come to the campus for a week of work experience at UNSW. This program was devised as companies complained that due to WHS, child protection and public liability regulations, it was very difficult for them to offer work experience to high school students. Academics from the School run activities in partnership with companies to offer work experience activities to students which doubles as marketing. Monies are also used to produce marketing material and a range of other activities run by the School.

For their support, industry partners receive access to the top students, preference for job listings, invitations to the elite student’s breakfast, careers market, promotion of the company logo within the School, opportunities to attend industry/academic forums and sponsorship of the annual 4th year prize. Some companies who are industry partners can leverage this further to present guest lectures to students or even part-fund an academic position and receive academic advice on their own research and development strategies.

4 CONCLUDING REMARKS

There is some concern in the NSW Surveying profession that UNSW graduates are not ‘job ready’ and cannot lead field parties from ‘day one’, but this is not the purpose of a UNSW qualification. The high ATAR, combined with a daily exposure to an intensive research culture, means that the School continually challenges undergraduate students with higher level activities and problems. Consequently, graduates should have a better capacity to advance rapidly in their profession and to adapt readily to take up management positions, leading to company/organisational directorship and business ownership. The profession will never be led by those who are content to remain unchallenged and stagnant as 100% field operatives in either Surveying or GIS whilst technology and the nation’s demands on the profession leaves them behind (Roberts, 2013).

The UNSW Graduate Capabilities include: “Leaders who are enterprising, innovative and creative; capable of initiating as well as embracing change. Professionals who are capable of independent, self-directed practice; capable of lifelong learning.” This is the goal to which SAGE staff aspire (UNSW, 2016).

The best students coming into this program have high expectations and graduate with ambition and self-confidence. They have been exposed to world-leading research during their degree, hence know that advances in technology will not only lift productivity, but will also create new business opportunities. They are ready to embrace change, not fear the future. They are looking for a career that challenges them, offers opportunities, and fulfils them. These graduates will most likely become future leaders. Educators and the wider industry in general must appreciate this and nurture them (Roberts, 2013).

UNSW offers a high-quality undergraduate education with an appropriate balance of prescribed and elective technical subject matter, management courses and communications training, and project-oriented learning. There is clear evidence that UNSW graduates do go on

to be leaders in industry and the profession.

It is hoped that this article will help readers appreciate the pressures on and the principles reflected in UNSW programs, and will actively support us in our quest to attract more high-quality students to aspire beyond UNSW.

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