

Collaborative and Sustainable Surveying Education in South Australia

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SUMMARY

Due to dwindling numbers, the Bachelor of Geoinformatics and Surveying at the University of South Australia (UniSA) was discontinued in 2006 and the final students from this degree graduated in 2009. However, the Surveyors Board of South Australia (SBSA) still foresaw a long term demand for a locally based tertiary educated cadastral surveying workforce and consequently initiated dialogue with UniSA to develop a different, more collaborative and sustainable model to encourage a new generation of cadastral surveyors into the South Australian workforce. The subsequent combined efforts between SBSA and UniSA resulted in the commencement in 2010 of a unique approach for Australia in surveying education, namely a coursework Master of Surveying. A key driver in this project was industry involvement in the development, delivery and direction of the degree, both financially and through in kind support. The overall aim for the project was to create a collaborative and sustainable tertiary level surveying education in South Australia that met the SBSA requirements for acceptance as a Registered Surveying Graduate. To date the collaboration has created a reinvigorated, up-to-date and visionary tertiary education model, built upon strong partnerships locally and nationwide that has produced quality graduates who have exceeded industry expectations.

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1. INTRODUCTION

Historically, surveying in South Australia was taught through a 3 and subsequently 4 year undergraduate degree, initially at the South Australian Institute of Technology (SAIT) and then, through absorption of SAIT in 1991, at the newly created UniSA. Over those years, to try and maintain a university education presence in South Australia, the surveying program changed, with amendments to course content and changes to surveying degree names occurring, until dwindling student numbers forced a last iteration of the education pathway in 2006.

In 2008, a report commissioned by the Cooperative Research Centre for Spatial Information (CRCSI) conservatively estimated that the spatial industry revenue in 2006-07 could have been of the order of \$1.37 billion annually. Surveying is a major part of the spatial information industry and plays a crucial part in the development and construction cycle. However, a recent report by BIS Shrapnel (2015) predicted that there will be a national shortage of nearly 7,000 surveyors and associated professionals by the middle of next decade. Within this report, BIS Shrapnel gave an outlook (Figure 1) for the South Australia Cadastral Surveying workforce, the branch of the surveying profession that is concerned with land management, and more specifically with issues of land ownership, measurement and delineation of property boundaries. In essence, demand for Cadastral Surveyors would exceed supply.

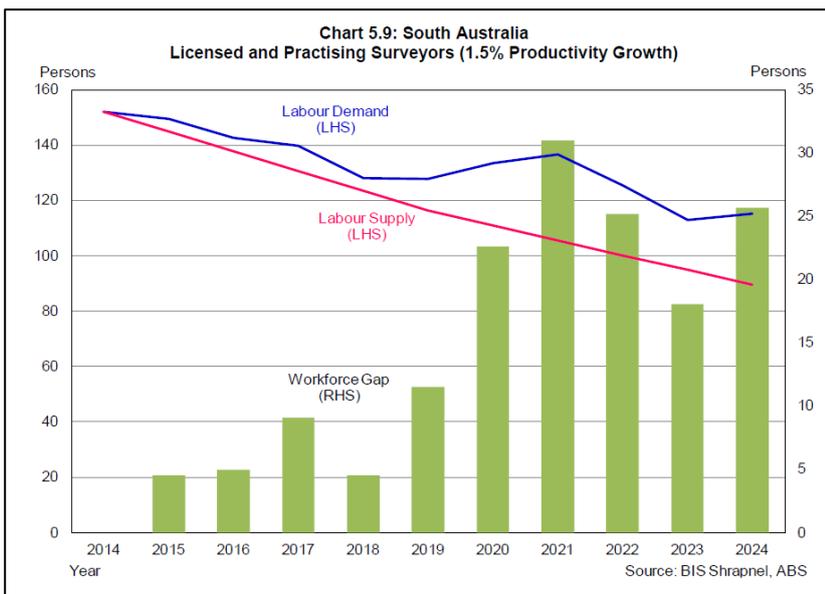


Figure 1: Projected demand for Cadastral Surveyors (BIS Shrapnel 2015)

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BIS Shrapnel indicated that due to the time taken to develop new surveying graduates (i.e. 4-6 years) education should occur in advance to help meet the future capability requirement. Such a foresight occurred in 2008 as the Surveyors Board of South Australia (SBSA) still believed in the importance of keeping a surveying educational pathway within South Australia. Consequently, in collaboration with UniSA, the feasibility of an alternative and unique approach to surveying education within Australia was investigated. The overall aim for the project was to create a collaborative and sustainable tertiary level surveying education in South Australia that met SBSA requirements for acceptance as a Registered Surveying Graduate. This Higher Education and Training collaborative venture created the Master of Surveying (<http://programs.unisa.edu.au/public/pcms/program.aspx?pageid=3642&sid=6437>), the only type of this degree in Australia. An integral part of the collaboration was a sustainable financial model. This was achieved through an amendment to the Survey Act 1992 that expanded the use of the Survey Plan Levy proceeds to include education funding and thus enabled SBSA to provide financial industry support to UniSA to aid the creation, delivery and promotion of the new Master of Surveying education program. The Master of Surveying program envisioned a duration of 1.5 years (the latter 0.5 years being studied part time to dovetail with industry/ student engagement expectations) and to build upon foundations laid from undergraduate education strong in broad geospatial science, including surveying, geographical information systems, mathematics and physics. Consequently, in 2010, the first 5 Year Funding Agreement between SBSA and UniSA to aid this unique approach to surveying education was operationalised.

This paper will detail the journey undertaken in the creation, promotion and maintenance of the Master of Surveying and conclude with some thoughts as to consequences of the program and possible future directions to ensure a sustainable education presence, not only in the state of South Australia, but nationwide across Australia.

2. MASTER OF SURVEYING FUNDING & STRATEGIC DIRECTIONS

Underpinning the whole Master of Surveying is the funding agreement and strategic directions established between SBSA and UniSA. The ultimate funding stream for the Master of Surveying can be traced back to the introduction of the Survey Act 1992 (the Act). The Act transferred certainly regulatory responsibilities and obligations for cadastral surveying from the State Government to the Institution of Surveyors, Australia, South Australian Division Inc. (the Division). (SBSA operates as the Management Committee of the Division and is authorised to exercise all of the powers of the Division under the Act.) The Act enabled the Division, after consultation with the responsible Government Minister, to levy certain fees and charges to meet the new obligations imposed upon it. This resulted in the Division establishing a funding regime comprising two main streams; firstly from all licensed surveyors through an annual licence renewal fee and secondly from users of the State cadastral system from the proceeds of a new Survey Plan Levy. The Survey Plan Levy is collected on surveys certified by licensed surveyors and lodged in the Lands Titles Office.

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This funding arrangement ensures that the costs are being borne by the users of the system, not from the general public purse. Thus, an agreement between the UniSA and the Division was signed in October 2009, for the funding of the Master of Surveying for an initial period of 5 years. To afford the required funding to UniSA, a one off increase of an additional \$30 to the Survey Plan Levy was sought to supplement the Division income. The agreement generated a budget of \$750,000 for the delivery of this unique educational model between 2010 and 2014 mostly funded by the increase of the Survey Plan Levy.

SBSA has the statutory responsibility for controlling the training and conduct of licensed and registered surveyors in this State, both in private firms and public agencies. SBSA includes the Chair of the Board, the Surveyor-General, an academic member, 3 surveying members and a Treasurer and all have been actively involved in the strategic direction of the Master of Surveying. Within UniSA, a team consisting of the Pro Vice Chancellor for the Division of IT Engineering & Environment, the Head of the School of Natural and Built Environments (NBE), the Master of Surveying Program Director and the dedicated UniSA surveying lecturer all similarly contributed to the strategic direction for the Master of Surveying and, in particular, the latter two to its operationalization in conjunction with the industry based lecturers.

Between SBSA and UniSA, the following 4 specific objectives were created on a contractual 5 year agreement basis:

- Ensure the presence of a permanent UniSA lecturer with significant expertise in land surveying
- Hire of sessional staff from the surveying industry to assist with the delivery of the degree
- Renew and/or purchase surveying equipment
- Develop promotional material for the marketing of the degree

3. COLLABORATION

To achieve the aim and objectives for the Master of Surveying, successful collaboration between the industry, academia and the student cohorts has been paramount. In essence, the collaboration in this project has been fourfold i.e.:

- SBSA & UniSA - Practising surveyors who lecture at UniSA expose students to facets of the surveying industry that they may not have encountered before and the latest developments within the industry. Furthermore, SBSA creates opportunities for Continuing Professional Development (CPD) for graduate and licensed surveyors who participate in Higher Education workshops with UniSA academic staff and utilising UniSA facilities.
- UniSA and students - Due to the boutique nature of the degree, lecturers and students form a close working relationship that enable the students to be closely monitored, coached and mentored into job ready graduates. In doing so, students are exposed to current industry standards, personnel and networks that aide their assimilation into the workforce.

- Students and Industry - It is an expectation that students are employed during their studies. To this end, SBSA and UniSA have been proactive in promoting work experience and paid employment for students. In addition, students present their end of final year projects to SBSA, who also have contributed to the project supervision and assessment. Furthermore, the projects are recognised by SBSA, where 13 weeks experience is accredited in their graduate training agreement to become a licensed surveyor.
- UniSA & other universities - Efficiencies have been gained at a national level through a UniSA/ University of Tasmania (UTas) collaboration where UTas deliver the photogrammetry course. This approach also exposes UniSA students to differing learning environments both in delivery i.e. live streaming of lectures and practicals from the UTas campus in Hobart, and also other university procedures, assessment and policies.

4. INNOVATION

In addition to the unique funding agreement and the flexibility in course delivery, the Master of Surveying has innovated in 2 further ways:

- Educational pathway - The traditional pathway for surveying education in Australia encompasses a 4 year Higher Educational route aligned with complimentary disciplines such as Engineering (see UNSW <http://www.engineering.unsw.edu.au/study-with-us/undergraduate-degrees/surveying> or University of Newcastle <https://www.newcastle.edu.au/degrees/bachelor-of-engineering-honours-surveying/why-study-with-us>). However, for the Master of Surveying, UniSA decided to introduce an alternative loosely based upon the European Bologna education model (aka Melbourne model in Australia) (Van der Wende, 2000; Devlin 2008) that espouses a two tier approach to education e.g. a 3 year undergraduate – generic in nature, followed by a specialization at post graduate level. A rationale underpinning this model is to allow for students to undertake more generic subjects at undergraduate level and in doing so expose them to differing disciplines, so they can make an informed choice of which pathway to specialise at Masters level. Thus, the preferred route to becoming a licensed surveyor in South Australia became the 3 year UniSA Bachelor of Geospatial Science (<http://programs.unisa.edu.au/public/pcms/program.aspx?pageid=744&sid=2082>) followed by a 1.5 years Master of Surveying. However, other routes into the Master of Surveying are available; e.g. from Flinders University's Bachelor of Applied Geographic Information Systems and from a Bachelor of Science at UniSA (majoring in Geospatial). Nevertheless, to align with the rest of Australia and ensure continued reciprocity between states and territories, the Master of Surveying was developed to allow students to exit after the first year of the Master of Surveying with a Graduate Diploma in Surveying (<http://programs.unisa.edu.au/public/pcms/program.aspx?pageid=222&sid=225>), and in doing so equated to 4 years level of education undertaken elsewhere in Australia.

- Alignment with a UniSA school dedicated to sustainability – The more traditional surveying education pathways in Australia are aligned with Engineering, but at UniSA, the Master of Surveying is housed within the School of NBE that comes together under the banner of sustainability, in recognition of the vital importance that this theme has on life. To this end, in addition to geospatial and surveying, the School of NBE offers degrees in Construction and Project Management, Civil Engineering, Urban and Regional Planning and Environmental Science. Geospatial technologies can be applied in many arenas, but it was seen to be advantageous for UniSA to align geospatial, and ultimately surveyors, within the sustainability development ethos of the School of NBE. The undergraduate Bachelor of Geospatial Science is, in essence, an environmental mapping degree, as it is aligned with environmental applications to complement the host School of NBE.

All of the innovations have faced challenges such as the funding agreement needing to convince State Government, the technological issues faced in regards to flexible and timely delivery from UTas, other universities and students appreciating a differing educational model and the idea that surveying does not have to be aligned with engineering. However, with consistent dialogue when needed, faith in the venture and the support of participating organisations, these hurdles have been overcome.

5. THE STRENGTH OF THE RELATIONSHIP

As mentioned earlier, towards the end of 2009, the surveying industry and education providers were proceeding down differing paths. However, due to some individuals within SBSA and UniSA with the foresight, drive and a will to see surveyors continuing to be trained in South Australia, a new embryonic relationship began. At that time, a quartet of people comprising the Chair of SBSA, the Surveyor-General, UniSA's Head of Environmental and Geospatial disciplines and the main surveying lecturer brought along their respective teams to the negotiating (and creativity) table to analyse the options available. From these firm foundations, the Master of Surveying was chosen as the educational route and within this degree, the SBSA and UniSA worked together to formulate the structure, courses and content that students would undertake to enable them to meet the SBSA requirements for acceptance as a Registered Surveying Graduate. But, with an eye on other aspects and thus alleviating any obstacles that may be put in the way with a focus solely on cadastral surveying, the collaborators decided not to call the degree a Master of Cadastral Surveying, moreover, it was mutually agreed that Cadastral should be omitted and that Surveying would remain as the umbrella nomenclature. This was intended to highlight the opportunities for other disciplines within surveying to be addressed, allowing for other non-cadastral surveying companies to see the worth of such a degree to potential recruits to their businesses, and also aid infrastructure projects within South Australia. SBSA were also novel in offering scholarships and awards to surveying students (and are currently investigating other ways such as in kind support) both at undergraduate and post graduate levels, with students being selected by panels comprised from both SBSA and UniSA staff. The key word in their overall aim for the collaboration was 'sustainable', and thus the collaboration needed to foster a relationship for the long term, not just the 5 year term of the funding agreement. Consequently, a crucial part of the relationship building

process was longevity and succession planning and thus, following positive industry and university feedback, this has been realised as a second round of funding has now been secured and operationalised for 2015-2019 with new people at the helm.

The working relationship has continued on the strategic level, for example, the Chair of SBSA is an integral member of the UniSA advisory board that oversees the Environmental and Geospatial degrees at UniSA. Also, the renewing of the funding agreement gave the opportunity for SBSA and UniSA to reflect on their relationship and the degree content. This period of reflection coincided with two other timely events, namely the release of the revised Australian Quality Framework (AQF) which is 'Australia's national quality assured framework of qualifications in the school, vocational education and training and higher education sectors' (AQF 2016) and the publication of the Fryer and Mitchell (2013) report in Surveying Education in Australia. Consequently, the Master of Surveying and the Bachelor of Geospatial Science 'feeder' degree were updated in a fashion that allowed improvements in content and also degree duration. For example, in regards to content, the Bachelor of Geospatial Science added computer programming, and in the Masters of Surveying Photogrammetry was reintroduced. In addition, a specific recommendation from the AQF process, suggested that Master degrees should move to a full 2 years duration. UniSA's Master of Surveying adhered to this and thus increased by 0.5 years in length that allowed 4 new courses to be accommodated e.g. the addition of a course focusing on the critical role surveyors play in land development.

A contemporary showcase in regards to the strength of this unique collaboration was a Committee for Economic Development of Australia (CEDA) business lunch seminar held in Adelaide during July 2015. SBSA sponsored the event to announce the second round of funding in amongst 300 senior business figures in South Australia to highlight the value of surveying in the areas of natural resources, infrastructure and land development. Furthermore, the SBSA and UniSA relationship are currently investigating the possibility of a jointly funded Professorial Chair for Surveying, a position that would help elevate the status and importance of surveying in the state, the presence/quality of the teaching and attract research funding to develop new and innovative ways for surveying in South Australia to progress.

6. OUTCOMES

The main outcome arising out of the collaboration has been the continuation of surveying education in South Australia that produces a local surveying workforce that has a global outlook on surveying and geospatial business.

In relation to the 4 project objectives stated earlier, the following outcomes have been achieved:

- Ensure the presence of a permanent UniSA lecturer with significant expertise in land surveying -
 - UniSA now has a permanent lecturer who possesses extensive cadastral surveying experience and resides as the academic member on the SBSA.

- This lecturer also engages in cadastral teaching education research to compliment and further enhance cadastral teaching knowledge and delivery.
- The lecturer has developed workshops for graduate surveyors who have entered a professional training agreement after their studies, to aid their continuing education post university until successful registration as a licensed surveyor.
- Hiring of sessional staff from the surveying industry to assist with the delivery of the Program
 - Practising licensed cadastral surveyors and other non-cadastral surveyors, from disciplines such as hydrographic surveying, land development and geodesy, continue to be pillars of strength to the program bringing in their extensive knowledge, skills and applications.
 - 11 private and public sector sessional lecturers contribute to the content delivery in specialty areas ranging from geodetic surveying to the drafting of surveying plans
- Renewal and/or purchase of surveying equipment
 - The funding from SBSA enabled approximately \$100,000 of new surveying equipment to be purchased by UniSA.
 - Since the initial purchase, the continuing SBSA funding has enabled these items to be supplemented as and when necessary.
- Development of promotional material for the Program & Marketing of the Program –
 - SBSA created a subcommittee (Surveying SA) to promote Surveying as career. The Surveying SA members are drawn from private and public sector surveying entities, universities, TAFE, as well as the peak professional body - the Surveying and Spatial Sciences Institute (SSSI).
 - Surveying SA has also used a marketing company to aid promotion e.g. a connection with the Surveyors Board of Victoria, to utilise a website called ‘a life without limits’ <http://www.alifewithoutlimits.com.au/> .
 - Surveying SA and UniSA have joined efforts in the efficient use of marketing material to be used in many expos and school career evenings.
 - UniSA marketing has also contributed promotional videos <https://www.youtube.com/watch?v=faJGt6C7efQ> and prioritised the Master of Surveying and its preferred underpinning Bachelor of Geospatial Science in its Marketing Strategy.
 - Student enrolments increase, particularly as prospective students can see the visible connection between the surveying industry and UniSA.

This collaborative project is building capacity within South Australia, both educationally and economically. Student numbers are on the rise and thus the foundations have been laid from which the Master of Surveying can grow and thus allow the required increase in the number of surveyors needed to be met. South Australia is primed and ready for the projected increase in development over the next decade.

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7. FUTURE SUSTAINABILITY

In line with good business practice, it is not sufficient to rest on one's laurels. To this end, SBSA and UniSA have echoed the facets of Continuous Improvement (CI), the Business Process Improvement technique Hammer and Champy (2003) defined as being a quality improvement program that seeks to enhance existing processes. The CI framework is conceptualised as a cyclical process, as illustrated in Figure 2 by Deming's Plan Do Check Act (PDCA) model.

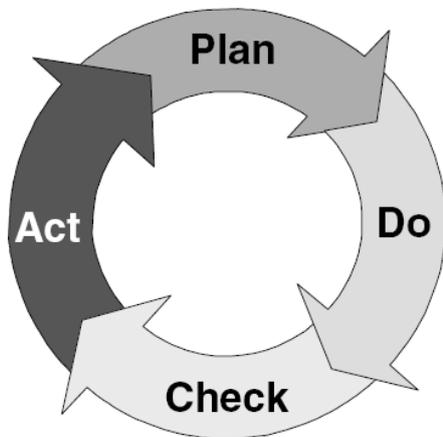


Figure 2: The Deming PDCA cycle of continuous improvement (Bell, 2006)

Using the PDCA model, SBSA and UniSA have so far undertaken one cycle having 'Planned' the change to the Master of Surveying back in 2008, 'Done' the change in 2010, 'Checked' how the change has performed during negotiations for the second round of funding and then 'Acted' upon those changes to improve the process (i.e. the degree). However, as Deming's model suggested, CI doesn't finish with the 'Act' section, as its name implied; it was geared towards a continual review process to continually improve organisational performance and thus it is now pertinent to reflect on what the future holds and how the degree or surveying education on the whole in Australia can become sustainable.

First, it would be worthwhile to take a holistic review of the process and time it takes to become a licensed surveyor in Australia and uncover issues that need to be addressed. In South Australia, the Survey Act 1992 regulations require that a person must possess a Graduate Diploma in Surveying or Master of Surveying Degree or equivalent 4 year Surveying Degree before being eligible to make an application for a licence to undertake cadastral surveys. An equivalent qualification is taken as being an interstate degree accepted by that State's licensing authority or an overseas surveying qualification assessed by the Bureau of Assessment for Overseas Qualification as being equivalent to an Australian degree.

As a precondition to licensing, an applicant must also have not less than two years practical experience in surveying through a professional training agreement (PTA) under the supervision of a licensed surveyor approved by SBSA. A licence is granted after PTA competencies are certified by

a supervisor, completion of a cadastral surveying professional assessment project and professional practice presentation to the satisfaction of SBSA. The timeframe to become a licensed surveyor in South Australia from high school graduation takes on average 10 years. The SBSA and the profession anticipate the timeframe for Master of Surveying graduates to become licensed will reduce due to the high quality collaborative education and training that graduates receive. Such a holistic review of the process and timeframes to become a licensed surveyor would identify opportunities for improvement.

Secondly, future research to compare and contrast surveying university degree programs and registration/licensing assessment process in operation within Council of Reciprocating Surveyors Boards of Australia and New Zealand (CRSBANZ) jurisdictions would be worthwhile. This type of review could lead to a common core curriculum which would assist in a) strengthening reciprocity across the geographical domain and b) allow for greater student mobility during the education process, as proposed in the Bologna declaration in Europe. It may also lead to a recognition of centres of Surveying education excellence which, where relevant, could contribute to on-line delivery of some material. Clearly, the University of Southern Queensland has been operating in this space for some time, but a trans-Tasman review and design of an ANZ Surveying education pathway may lead to considerable economies of scale and operation leading to not just state based sustainability, but suitability at national scales for the production of fully licensed Surveyors.

8. CONCLUSIONS

The Master of Surveying collaboration between SBSA and UniSA has perpetuated the belief that there is a future for surveying education in South Australia from a student, industry and university perspective. The readjustment of the surveying education has taken a few years to reestablish but it is now well positioned for the future to deliver the demand in surveyors that has been reported in the aforementioned BIS Shrapnel Report that indicates South Australia will require more surveyors from 2018 onwards.

Given the increasing average age of Cadastral Surveyors across Australia, the reigniting of surveying education in South Australia has enabled a new wave of surveyor to enter the industry equipped with both surveying and geospatial skills. This timing allows the new graduate surveyor to embed themselves in the industry before the older generation moves on. In doing so, succession is ensured with graduates maturing, and thus becoming the leaders of the surveying industry, again reinforcing the sustainable aspect of the collaboration between SBSA and UniSA.

SBSA is heavily involved with the final year's projects in supervising, mentoring and assessment roles e.g. each student is assigned 2 members of the SBSA to aid the supervision process. On completion of their final year projects, SBSA members attend the student seminars and contribute to the marking of the work presented. Throughout the Master of Surveying, students engage with senior members of the surveying profession, which benefits the industry and also the academics. The students are continually seeing real life applications of the theory and knowledge they are acquiring through their studies, thus making what they learn at UniSA more relevant.

SBSA has noted that the graduates from the Master of Surveying have started their training agreement to become licensed cadastral surveyors at an accelerated rate. This has been due in the main to the extra and above required level of knowledge gained from undertaking the fifth year of education i.e. 1 year more than the other states and territories in Australia and New Zealand that continue with the 4 year model, and that in the 2nd year, their final year projects count toward their post tertiary education training agreements, thus potentially reducing the time it takes to obtain a full cadastral surveying licence.

Finally the, Master of Surveying may have a cultural impact on surveying education as a whole in Australia. There is still a lack of support from universities in Australia to maintain degrees with small numbers (such as surveying) and this collaborative model could provide enormous assistance in persuading them otherwise. Adhering to the mantra of continuous improvement, the surveying educators in Australia need to constantly scan their environments and investigate methods to keep surveyor education alive, vibrant and at the cutting edge. The suggestion outlined in the previous section should be investigated in the near future to ensure Australian surveying education sustainability.

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BIOGRAPHICAL NOTES

Mr Michael Nietschke graduated from the South Australian Institute of Technology in 1985 with a Bachelor of Applied Science in Surveying. Michael has more than 25 years of experience in the field of land development and residential construction, working 15 years in the private sector with Alexander Symonds and over 12 years in the public sector currently with Urban Renewal Authority trading as Renewal SA. In 1997 he qualified as a Licensed Surveyor under the Survey Act 1992 and in 2008 became a member of the Surveyors Board of SA and in 2012 awarded the position as chairman which he currently holds.

Associate Professor David Bruce is an Associate Head of the School of Natural and Built Environments at the UniSA and an adjunct faculty member of the International Space University in France. He has a long experience in surveying, GIS and remote sensing education and undertakes researches in the areas of high spatial resolution, space borne remote sensing and polarimetric SAR imagery.

Dr Paul Corcoran joined the Ordnance Survey, Great Britain's national mapping agency in 1984 and undertook various surveying, Geographical Information Systems (GIS) and management roles, predominantly in the North of England. In 2006, he joined the School of Natural and Built Environments at the University of South Australia, Adelaide, as a Geospatial Science Lecturer. In 2013, he became Program Director for the Bachelor of Environmental Science, Bachelor of Geospatial Science and Master of Surveying.

Mr Scott Allen has over 25 year experience as a Licensed Surveyor in South Australia, and since 1997 has been involved in surveying education in a variety of capacities in the tertiary sector. He is currently employed as a Lecturer in Land Surveying in the School of Natural and Built Environments at the University of SA, and has teaching responsibilities in both undergraduate and post-graduate surveying courses. He has also been a member of the Surveyors Board of SA since 2005, currently serving as the Academic Member.

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